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Subject # Advance Engg Surveying

Section # B

Submitted to # Eng Farkhan Khattak

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Q #1

⇒ What is Transition Curve? How Super elevation is effected by -----  
-----?

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 the vehicle moves from tangent on the curve the forces acting on it are -

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→ weight of the vehicle  
→ Gravity of the vehicle.

Let

$w \Rightarrow$  weight of vehicle

$P \Rightarrow$  Centrifugal force

$V \Rightarrow$  speed of vehicle, m/s

$g \Rightarrow$  Acceleration due to gravity -

$R \Rightarrow$  Radius of the curve -

$w \Rightarrow$  Super elevation -

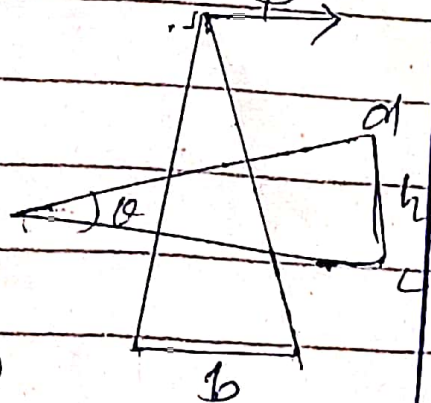
$b \Rightarrow$  width of the road -

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 -

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

$$\frac{P}{w} = \frac{V^2}{gR}$$

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



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$$\tan \theta = \frac{h_0}{b} = \frac{P}{W} = \frac{V^2}{gR}$$

$$h_0 = b \tan \theta$$

$$h_0 = \frac{b V^2}{gR} \rightarrow \text{on highway}$$

$$h_0 = \frac{b G V^2}{gR} \rightarrow \text{on Railway}$$

⇒ 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 -

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Q# 02

⇒ What is the difference b/w Triangulation & Trilateration?

## Trilateration

⇒ All sides are measured in Trilateration -

⇒ 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 same geometric figure -

⇒ The angles are computed on the basis of measured side lengths applying cosine law -

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## Triangulation & its principle

⇒ Triangulation is a highly accurate and precise method of ~~est~~ 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 triangulation system are computed

Indirectly from the lengths of the sides of triangle by cosine formula.

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⇒ Few horizontal angles are also some times measured to provide a check on computed angles -

⇒ Iteration is adjust after the computation of the angles and then co-ordinates of the station 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

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

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

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$A = \cos^{-1} \left( \frac{b^2 + c^2 - a^2}{2bc} \right)$$

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## Triangulation

- All angles are measured in triangulation -
- Distance of the base line is measured.
- ⇒ Some check of base line are also measured to control scale error -
- Intervisibility b/w stations 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 -

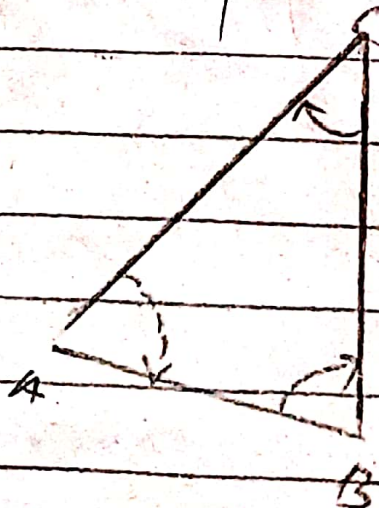


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## Triangulation & its principle

⇒ it is the process of measuring the angle of a chain or network of triangles formed by stations marked on the surface of 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 co-ordinate of vertices -



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

⇒ Again, if the co-ordinates of any vertex of the triangle and azimuth of any side are also known, then co-ordinates of the remaining vertices may be computed -

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Q#03 (a)

What is hydrographic survey? . . . . .  
. . . . . ?

Ans → Hydrographic 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 drilling etc.

→ Hydrographic Surveying is mainly conducted under authority concern -

→ It is mainly carried by means of sensor, sounding or electronic sensor system shallow water -

Q#03 (b)

Sounding: The measurement of depth below the water surface is called sounding. This corresponds to the Ordinary spirit leveling in land surveying where depths are measured below horizontal line established by level.

The object of making sounding is thus to determine the configuration of subaqueous source.

Purpose of Sounding

⇒ Sounding is the most important for any water body to improve its navigable properties, to know about siltation and scouring etc.

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

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⇒ Factors 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 review of existing data)

(c) Issue to a designated unit

(d) program 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 -

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⇒ 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 structure like bridges, dams, harbours are planned.

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## Equipment

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

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Q# 04(a)

what is aerial  
photogrammetry and why  
we do it?

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

⇒ In terrestrial photogrammetry  
photographs are taken from  
a fixed position on  
ground while in the  
aerial photogrammetry, an  
aircraft with camera setup  
is used to take photographs  
from the air flying over  
the ground.



Reasons for use of Aerial  
Photogrammetry

⇒ Following are some of the reasons 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 dimensions and physical features of the area of land and in.

stunning accuracy.

These models can be easily rotated & zoomed.

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

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Q#04 (B)

## Procedure of aerial photography

- (i) Establishing control points
- (ii) Flight planning and photography
- (iii) Photo Interpretation & stereoscopy
- (iv) Parallax and measurement of parallax.
- (v) Construction of map and cartography.

### Establishing control points

⇒ 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.

(iii) Photo Interpretation and Stereoscopy

⇒ Photo Interpretation is done by the instrument called stereoscope which contains magnifiers -  
So one can observe the 3-D model of area through it -

(iv) 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 point of observation is shifted to another angle -

(v) Construction of Map & Cartography

After collecting all photographs - it is time to create or plot the map - There are several methods available to plot the details - e.g. ⇒ Stereoscopic Method -