

FINAL EXAM SPRING 2020

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SECTION : 'B'

PAPER : ADVANCE ENGINEERING  
SURVEY II

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QUESTION No.1TRANSITION CURVE:DEFINITION:

"A curve of varying radius is called transition curve."

It is also called spiral curve or Easement curve.

The transition curve is used in both railway and roads b/w tangent and a circular curve in order to have a smooth transition from tangent to the curve and from curve to the tangent.

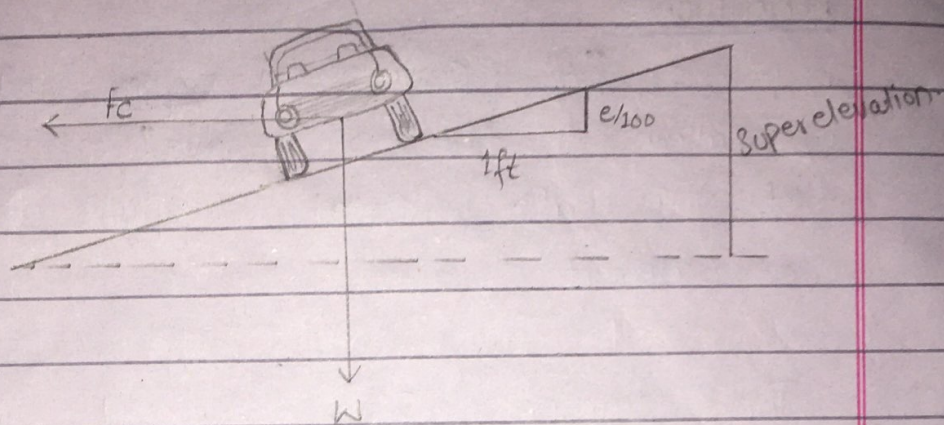
The transition curve is also inserted b/w two branches of compound.

SUPER ELEVATION:DEFINITION:

"Superelevation is the transverse slope provided to counteract the effect of centrifugal force and reduce the tendency of vehicle to overturn and to skid laterally."



outward by raising the pavement outer edge with respect to inner edge."



### REPRESENTATION:

It is represented by "e".

### DEPENDS:

The amount of superelevation depends on two things and also it affects the amount of superelevation.

- (i) Speed of vehicle
- (ii) Radius of the curve

### PROOF:

Superelevation is affected by speed of vehicle and radius of curve.

Let

$W$  = Weight of the vehicle

$P$  = Centrifugal force

$V$  = Speed of vehicle (m/s)



$g$  = Acceleration due to gravity ( $m/s^2$ )

$R$  = Radius of Curve (m)

$h$  = Super elevation (m)

$b$  = Width of the Road (m)

Now for equilibrium the Resultant  $R$  of the Centrifugal force and Weight of vehicle must be equal & opposite to the reaction perpendicular to road or rail surface.

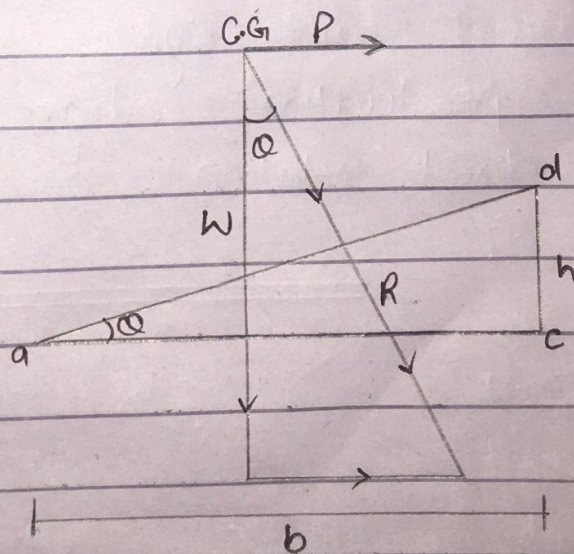
Now we know that

$$P = \frac{mv^2}{R}$$

Where  $w = mg \Rightarrow m = \frac{w}{g}$

$$\Rightarrow P = \frac{wv^2}{gR}$$

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



Now From the

$\Delta acd$

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

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



$$\Rightarrow h = b \tan \theta \quad \text{--- (i)}$$

$$\text{Put } \tan \theta = \frac{v^2}{gR} \quad \text{in eqn (i)}$$

$$\Rightarrow h = b \frac{v^2}{gR} \quad \text{--- On highway}$$

$$\Rightarrow h = b \frac{Gv^2}{gR} \quad \text{--- On Railway.}$$

where  $G_1 =$  Distance b/w center of rail.

Now if the radius of the curve is small the superelevation is greater. and viceversa. It has inverse relation with radius.

Now if the speed of vehicle we want high so we kept superelevation high. i.e It has direct relation b/w each other.



QUESTION No.2.DIFFERENCE BETWEEN TRIANGULATION & TRILATERATION:TRIANGULATIONTRILATERATIONDEFINITION

Triangulation is a method which consists of a number of interconnected triangles in which the length, only one base line and the angles of the triangles are measured very precisely which are used to calculate the coordinates of vertices.

Trilateration is a highly accurate and precise method of establishing and expanding horizontal control points, in which the lengths of all sides of chain of triangles, polygons, or quadrilateral are measured with an electronic instrument or the angles then may be computed from these field instruments.

MEASUREMENT

In triangulation the distance of baseline is measured

In trilateration Azimuth of initial line is measured.



SIDES AND ANGLES

All the angles are measured in triangulation.	All sides are measured in trilateration.
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CONTROL ERROR

Some check base line are also measured to control scale error.	Some check angles are measured to control azimuth error.
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INVISIBILITY

Invisibility b/w station is essential.	For small areas it is possible to measure distance without invisibility.
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CHECKS

These are more internal checks in comparison with trilateration in the same geometric figure.	These are less internal checks in comparison with triangulation in the same geometric figure.
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COMPUTATION

The side lengths are computed on the basis	The angles are computed on the basis of measured
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of measured angles applying  
sin law.

side lengths applying  
cosine law.

### PRINCIPLES OF TRIANGULATION:

i) In triangulation the lines forming a network lies together, all the triangulation stations at the vertices of the triangles.

ii) If all the base three angles and the length of one side of a triangles are known then by trigonometry the lengths of the remaining sides of the triangle can be calculated.

### SINE RULE:

$$\frac{a}{\sin \alpha} = \frac{b}{\sin \beta} = \frac{c}{\sin \gamma}$$

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

### EXAMPLE:

Bridge site survey.



PRINCIPLES OF TRILATERATION:

- i) All the three sides of each triangle are measured in the field with distance measuring instruments (EDMs, tapes, other apparatus).
- ii) Horizontal angles are not measured in the field.
- iii) Angles in a trilateration system are computed indirectly from the lengths of the sides of triangles by cosine law.

COSINE LAW:

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

$$b^2 = a^2 + c^2 - 2ac \cos \beta$$

$$c^2 = a^2 + b^2 - 2ab \cos \gamma$$

- iv) Few horizontal angles are also sometimes measured to provide a check on computed angle.
- v) Vertical angles are also measured where elevations have not be established.



QUESTION No. 3(a)HYDROGRAPHIC SURVEY:DEFINITION:

"The branch of surveying which deals with water bodies e.g. lake, river etc. is called hydrographic survey."

The usual fundamental principles of surveying and levelling are adopted for acquiring data for determination of.

- i) Water volume
- ii) Rate of flow
- iii) To determine the shape of the area underlying the water surface.

PURPOSE OF HYDROGRAPHIC SURVEY:

- i) It is used to determine the the subaqueous excavations.
- ii) Measure areas subjected to scouring or silting in harbours or docks.
- iii) It is used to locate the rocks and other objects such as buoys, lights etc.



to aid safe navigation.

- iv) To prepare navigation charts exhibiting the depths available for navigation.
- v) Control floods, and to plan water supply and storage from river.
- vi) To develop water resources for power, irrigation and recreation.

### FACTORS CAN BE DETERMINE WHILE DOING HYDROGRAPHIC SURVEY:

- i) Depth of bed can be determined
- ii) Shore lines can be determined.
- iii) Locating Sower fall by measuring direct current.
- iv) Locating mean sea level.
- v) Tide measurement.
- vi) River and stream discharge measurement.



QUESTION No. 3(b)SOUNDING:DEFINITION:

"The Process of determining depths below the water surface is called Sounding."

- Sounding is analogous to levelling on land.
- The reduce level of any point on the bottom of a water body is obtained by subtracting the sounding the mean sea level.

PURPOSE OF SOUNDING:

These are following Purpose of Sounding.

- i) To determine the depth of water below the surface water.
- ii) Preparation of accurate charts for navigation.
- iii) To determine the quantities of material to be filled.
- iv) Obtaining information for design of breakwaters, sea, well etc.



EQUIPMENT USE TO DETERMINE SOUNDING:

There are following equipment use to determine the sounding.

i) Shore signals and buoys

- a) Wooden tripod
- b) Wooden float

ii) Soundline equipment.

- a) Sounding boat
- b) Sounding pole or rod.
- c) Lead line
- d) Weddell's Sounding Machine
- e) Echo sounding Machine / Fathometer.

iii) ANGLE MEASURING EQUIPMENT:

- a) Theodolite
- b) Prismatic Compass
- c) Sextant.



QUESTION No. 4(a)AERIAL PHOTOGRAMMETRY:DEFINITION:

"Aerial Photogrammetry is the branch of surveying deal with production of maps such as topographic maps by compiling a number of photographs taken in that area."

PURPOSE OF AERIAL PHOTOGRAMMETRY:

There are following purpose of aerial photogrammetry.

- i) It is used to make the topographic map. These maps is used by the Army for military purpose.
- ii) It is used in ecotography, land use planning, archeology, movie production, environmental studies. etc.
- iii) It is used also in agriculture purpose.
- iv) It is difficult to survey the large area by foot, so we use Aerial Photogrammetry.



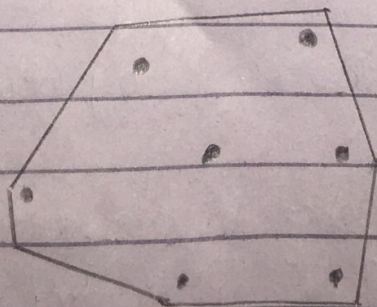
QUESTION No. 4(b)PROCEDURE OF AERIAL PHOTOGRAMMETRY:

There are following steps to conduct Aerial Photogrammetry.

- i) Establishing Control Points
- ii) Flight Planning and Photography.
- iii) Photo interpretation and stereoscopy.
- iv) Parallax and measurement of parallax.
- v) Construction of map and cartography.

i) ESTABLISHING CONTROL POINTS:

Control points are the points established on ground with known relative positions. The photograph captured is observed by setting these control points as boundaries. The points should be established in such a way that it can be easily identified in photograph. There should be 3 to 4 minimum control points.





## ii) FLIGHT PLANNING AND PHOTOGRAPHY:

Flight planning is the height knowing to be maintained by flight while take photo, area to be covered in each photograph, number of photograph no. of strips and time interval b/w exposures. The planning mainly depends on.

- i) Area of surveyed
- ii) Focal length of camera.
- iii) Overlap
- iv) Scale of photograph.
- v) Ground speed of aircraft in still air.

## iii) PHOTO INTERPOLATION AND STEREOSCOPY:

Photo interpolation 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.

## iv) PARALLAX AND MEASUREMENT OF PARALLAX:

Parallax is a displacement of an object in the photograph when



Point is shifted to another angle. This displacement can be measured.

## v) CONSTRUCTION OF MAP AND CARTOGRAPHY:

After collecting the all the photographs and information, it's time to plot the map. There are several methods available for plotting a map. One of them is stereoscopic method.

### STEREOSCOPIC METHOD:

An stereoscopic plotting method an instrument called stereoscope or stereo plotter or multiplex is used for preparing a map. This map is of high precision.

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