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Q01 **Transition Curve** A curve of varying radius is called transition curve b/w tangent and circular curve. It is also known a spiral curve it can be inserted in b/w the two ~~Type~~ branches of a compound or reven curve.

Types Three common type are

(i) Cubic Parabola (railways)
(ii) clothoid or spiral railways)
(iii) Lemniscate (Highways)

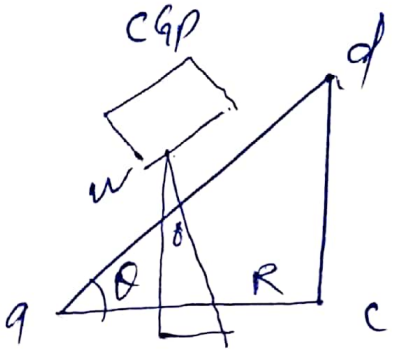
Super Elevation It is the ~~Type~~ by which the outer edge of a curve on a road or railway is banked above the inner edge when a vehicle passes to a curved path, Following Forces are actiy on it

(1) weight of vehicle
(2) Centrifugal Force both acting cactr of gravity of vehicle

The effect of centrifugal Force is to push the vehicle off the track. ~~Now~~
The plane of the road surface is made perpendicula to resultant of centrifugal Force and

weight of vehicle.
In other words the outer banks of road is raised above the inner side. This raising of outer bank over the inner side is know is super Elevation

Mathematicaly



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
b = width of road
G = Distance btw cut of rail
For Equilibrium
The resultant of weight & centrifugal force must be equal and opposite to the reaction perpendicular to road.

As we know that

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

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

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

So we have

$$\tan\theta = \frac{dc}{ac} = \frac{P}{W} = \frac{bv^2}{gR}$$

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

on Railway $\quad G\tan\theta = \frac{Gv^2}{gR}$

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

$$\boxed{R = \frac{v^2}{b\tan\theta g}}$$ — (For road)

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

$$\boxed{R = \frac{Gv^2}{b\tan\theta}}$$ — (For railway)

speed of vehicle

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

$v^2 = b\tan\theta gR$

$$\boxed{v = \sqrt{b\tan\theta gR}}$$ — (For road)

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

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

$$\boxed{v^2 = \sqrt{\frac{b\tan\theta gR}{G}}}$$ — (For railway)

Q02

(a) Triangulation Triangulation is a process in Surveying in which tracing and measurements of a series or a network of triangle is used for determining distance and relative positions of points over an area

Principle of Triangulation

In triangulation all the three angles of each triangle are in the field along with one base line.

- The side of the first triangle whose length is pre determined is called "base line" and vertices of the individual triangles are known as triangulation station
- To minimize accumulation of error in length subsidiary bases at suitable intervals are provided.

(b) Trilateration The method of Surveying in which the lengths of the sides of a triangle are measured and from this information angle are computed This method does not involve the measurement of angles.

Principles of trilateration

- It is a method of control survey in which a network of triangle is used as in triangulation
- All the three side of each triangle are measured in the field with distance measuring instrument.
- Horizontal angle are measure in the field
- Trilatration is adjusted after the computation of the angle & then coordinate of the station are determined.
- In trilatration angles are computed indirectly from the lengths of the side of triangle

Difference b/w triangulation & trilatration

1. In triangulation, All angles of the triangle are measured while in trilatration all side of triangle are measured
2. In triangulation base line is measured, while in trilatration initial line is measured
3. For triangulation, intervisibilty b/w station are essential in trilatration it is possible to measure distance with out intervisibility
4. There are more internal check in triangulation as compared to that of trilatration.

Q3 Part A

Hydrographic Survey :- Hydrographic surveying is the survey of physical features present underwater. 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 concern authority.

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

1) Depth of bed can be determine
2) Shore lines can be determine
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 are planned.

Factor to be determined while Conducting Hydrographic Survey

Following Factor would be done while survey-

1) Survey Equipment
2) Preparation of Hydrographic Survey specification
3) Issue to a designated unit
4) Programe planning of that unit
5) Assessment of task with in that unit
6) Resouce allocation
7) Detailed survey planning
8) plans For compilation and checking of data.

Q03 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 is thus to determine the configuration of the sub aqueous source

Purpose of sounding

For any water body to improve its negligable Properties to know about silting and scouring etc
- In hydrographic surveying sounding is the measurement of depth below the water surface.

Equipment

(i) Sounding boat
(ii) Sounding rods & poles
(iii) lead lines
(iv) Sounding Machine
(v) Fathometer

Q4 Part A

Aerial photogrammetry: is process in which an aircraft with camera is used to take photo from certain height in the air A mini 3 to 4 control point need in on photograph.

Reason For use of Aerial photogrammetry

It is used because it provides computer generated 2D and 3D models they model are dimensions and physical features of the area of land
they model can be rotated and zoomed Along with survey may of the Ariel photograph in different Field,

(10)

Q4 part B

Procedure of Aiel photography

1. Establishing control points
2. Flight planing & photography
3. photo interpretation & stereoscopy
4. parallax and measurement of parallax
5. Construction of map and Cartography

1. **Establishing Control points** Control point are point established on ground with known relative Position. The photograph ~~Captured~~ Captured is observed by setting the Control point as boundries there should be mini 3 to 4 point in a photograph.

2. **Flight planning & photography** is actully know the light to be maintained ~~which~~ while taking Photo area be covered in each photograph, Number of photograph, number of strips and Time interval b/w exposure.
