



Name

Mangoor Khan



ID

7678

Section

C

Paper

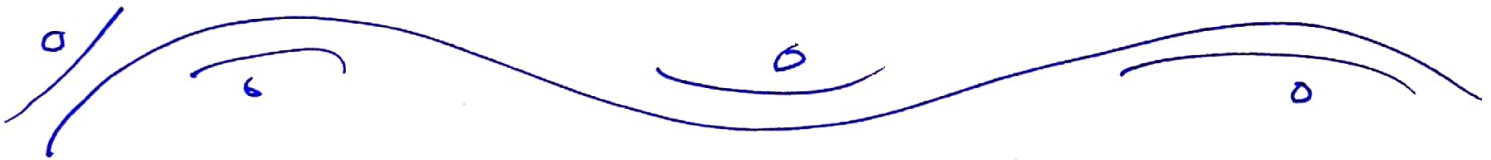
Advance Engineering
Surveying

Submitted to

Engr. ~~Farhan~~ Abdul Farhan

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Q No 1Given data:

$$\Rightarrow \text{Radius of 1st arc is} = 7678 - 300$$

$$R_S = 7378 \text{ m}$$

$$\Rightarrow \text{Radius of 2nd arc} = R_L = 7678 - 200$$

$$R_L = 7478 \text{ m}$$

\Rightarrow chainage of Intersection point;

$$\text{ch. of I} = 7678 - 400$$

$$= 7278 \text{ m}$$

$$\Rightarrow \Delta AKM = 130^\circ$$

$$\Rightarrow \Delta KMC = 140^\circ$$

Required data:

\Rightarrow chainage of tangent point and point of compound curve = ?

Solution:

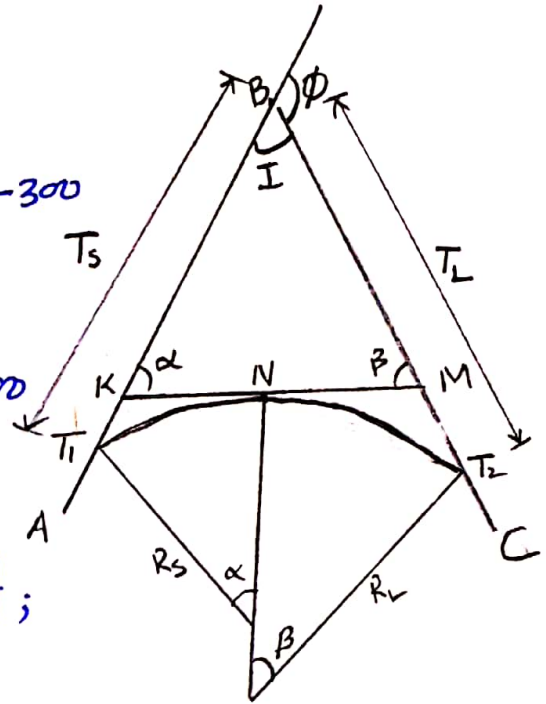
$$\Rightarrow \alpha = 180^\circ - 130^\circ = 50^\circ$$

$$\Rightarrow \beta = 180^\circ - 140^\circ = 40^\circ$$

$$\Rightarrow \phi = \alpha + \beta = 50^\circ + 40^\circ = 90^\circ$$

$$\Rightarrow I = 180^\circ - 90^\circ = 90^\circ$$

Now;



(2)

$$\Rightarrow KT_1 = KN = R_s \tan\left(\frac{\alpha}{2}\right) = 7378 \tan\left(\frac{50^\circ}{2}\right) \\ = 3440.42 \text{ m}$$

$$\Rightarrow MN = MT_2 = R_L \tan\left(\frac{\beta}{2}\right) = 7478 \tan\left(\frac{40^\circ}{2}\right) \\ = 2721.77 \text{ m}$$

Now;

$$\Rightarrow KM = KN + MN = 3440.42 + 2721.77 \\ = 6162.19 \text{ m}$$

Now; by Sin Rule Find BK and BM;

$$\Rightarrow BK = \frac{MK \sin \beta}{\sin(I)} = \frac{6162.19 \times \sin(40^\circ)}{\sin(90^\circ)} \\ = 3960.98 \approx 3961 \text{ m}$$

$$\Rightarrow BM = \frac{MK \sin \alpha}{\sin(I)} = \frac{6162.19 \times \sin(50^\circ)}{\sin(90^\circ)} \\ = 4720.5 \text{ m}$$

Now;

$$\Rightarrow T_s = KT_1 + BK = 3440.42 + 3961$$

$$\Rightarrow \boxed{T_s = 7401.42 \text{ m}}$$

$$\Rightarrow T_L = MT_2 + BM = 2721.77 + 4720.5$$

$$\Rightarrow \boxed{T_L = 7442.27 \text{ m}}$$

Now;

$$\Rightarrow L_s = \frac{\pi R_s \alpha}{180^\circ} = \frac{\pi \times 7378 \times 50^\circ}{180^\circ} \\ = 6438.52 \text{ m}$$

$$\Rightarrow L_L = \frac{\pi R_L \beta}{180^\circ} = \frac{\pi \times 7478 \times 40^\circ}{180^\circ}$$

$$= 5220.62 \text{ m}$$

Now;

$$\text{chainage of } T_1 = \text{chainage of } I - T_6$$

$$= 7278 - 7401.42$$

$$= -123.42 = 123.42 \text{ m}$$

$$\text{ch. of Compound of Curvature} = \text{ch. of } T_1 + L_s$$

$$= 123 + 6438.52$$

$$= 6561.52 \text{ m}$$

$$\text{chainage of } T_2 = \text{ch. of } N + L_L$$

$$= 6561.52 + 5220.62$$

$$= 11782.14 \text{ m}$$



(4)

Q No 2: Transition Curve:

Answer: A curve of varying radius is called a Transition Curve. It is also called Spiral Curve or Easement Curve.

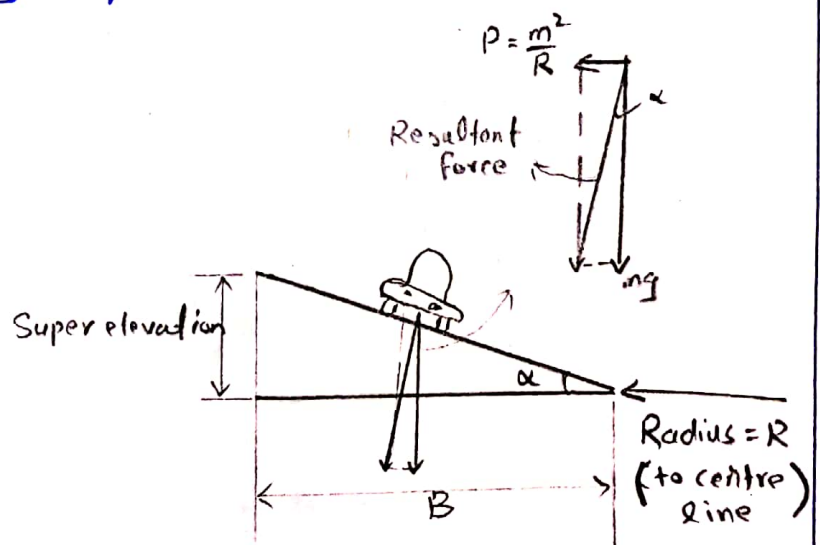
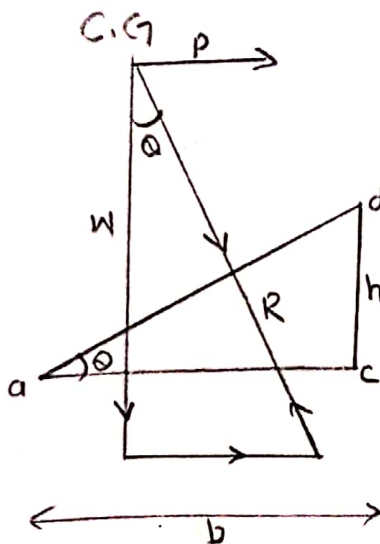
How Super elevation is effected by speed of vehicle and radius of Curve. = ?

The amount of Super elevation depend upon

- * Speed of the vehicle
- * Radius of Curve.

When vehicle moves from tangent on to the Curve the forces acting on it are;

- Weight of the vehicle
- Centrifugal force, Both acting through the Centre of gravity of the vehicle.



(5)

Let; W = weight of the vehicle

P = Centrifugal Force

V = Speed of the vehicle, m/s

g = Acceleration due to gravity, m/s^2

R = Radius of the Curve

h = Super elevation, m

b = width of the road, m

For equilibrium the Resultant "R" of the P and W must be equal and opposite to the reaction perpendicular to road or rail surface

$$\Rightarrow P = \frac{mv^2}{R} = \frac{wv^2}{gR} \quad \therefore w = mg$$

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

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

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

$$\Rightarrow h = b \tan \theta$$

$$\Rightarrow h = b \frac{v^2}{gR} \dots \dots \text{on highway}$$

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

where G = Distance b/w the Centre of the rail.

Q No 3:

Answer: Differen Blw triangulation and Trilateration.

Triangulation

Trilateration.

- | | | |
|----|--|---|
| 1 | All angles are measured in triangulation | 1. All Sides are measured in trilateration. |
| 2 | Distance of Base line is measured. | 2. Azimuth of the initial line is measured |
| 3 | Inter visibility b/w station is essential. | 3. For Small areas it is possible to measure distance without Inter visibility. |
| 4. | Some check base line are also measured to Control Scale error. | 4. Some check angles are measured to Control azimuth error. |
| 5. | There are more internal check in Comparison with trilateration in the same geometric figure. | 5. There are less internal check in Comparison with triangulation in the same geometric figure. |
| 6. | The Side lengths are Computed on the basis of measured angles applying Sine law | 6. The angles are Computed on the basis of measured Side lengths applying Cosine law. |

⇒ Principle of triangulation:

- ① If all the three angles and the length of one side of a triangle are known, then by trigonometry the length of the remaining sides of the triangle can be calculated.
- ② Again, if the coordinates of any vertex of the triangle and azimuth of any side are also known, then coordinates of the remaining vertices may be computed.

Sine Rule:

$$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)} \quad (\text{for finding sides})$$

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c} \quad (\text{for finding Angle})$$

⇒ Principle of trilateration:

- (1) Trilateration is a highly accurate and precise method of establishing and expanding horizontal control.
- (2) Method of Control Survey in which a network of triangles is used as in triangulation system.
- (3) All the three sides of each triangle are

- measured in the field with the distance measuring instrument (EDMs, tapes, etc).
- (4) Horizontal angles are not measured in the field.
 - (5) Angles in the trilateration system are computed indirectly from the length of the sides of triangle by cosine formula
 - (6) Few horizontal angles are also sometimes measured to provide a check on computed angles.
 - (7) Trilateration is adjusted after the computation of the angles and then coordinates of the system are determined.
 - (8) Vertical angle are also measured where elevations have not been established.

Cosine Rule:

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

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

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

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



Q No 4)

Ans: (a) Hydrographic Survey:

Hydrographic Surveying is the branch of the Survey which deal with any body of still or running water i.e a lake, harbour work, stream or river.

Hydrographic Survey are used to define shore line and under water features.

Hydrographic Survey are ~~used~~ ~~to~~ ~~be~~ made to acquire and present data on lake, bay or harbour.

Why do we do it?

(1) Measurement of tides for sea coasts i.e construction of the sea defense work, harbors etc.

(2) Determination of the bed depth by Sounding:

- For Navigation
- Location of rock, sand bar, buoys, navigation lights etc.
- For location of the under water works, volume of the under water excavation etc.
- In connection with irrigation and land drainage scheme.

(3) Determination of direction of current in connection with:

(10)

- Location of Sewer out Fall
- Determination of the areas subjected to Silt and Scour.
- for Navigation purposes.

(4) Measurement of quantity of water and flow in connection with water Scheme, power Scheme flood control etc.

Factor of Hydrographic Survey:

(1) To measurement of depth of water at various points is termed as Sounding.

(2) volume of water, Rate of flow, and The Shape of the area having water bodies.



Q5)

Ans (a) aerial Photogrammetry:

Aerial or Air photogrammetry is the branch of photographic Surveying in which the maps are produced from air photographs (photographs taken from air).

Why we do it:

1. The Survey work can be carried out with great speed
2. It can be used with great success for other purposes i.e Classification of land or soil, geological or archeological investigation etc.
3. Aerial Survey is highly technical and specialized work and must be carried out by a skilled trained and experienced person.
4. It is mainly made by government organization e.g Survey of Pakistan Department.

Q5)

Answer: Part(b):

Procedure of Aerial photography:

~~There are two ways of taking~~

1. Verify that the weather condition are suitable

For flying

2. Mount the aerial camera according to established procedure. Test the camera to ensure that it functions properly.
3. Fly the design routes and take the photographs according to plans.
4. Process the film according to specification to ensure radiometrically and geometrically quality images.
5. If necessary, print on the negatives the missing photo information, such as serial number or dates, project information etc.
6. Verify that all the photographs have enough end laps to assure stereoscopic coverage of the entire project area.
7. A similar inspection should be made to verify complete side lap coverage.
8. Each strip overlaps the adjacent strip by at least 30% to make sure that no part of the ground is left unrecorded.

