

Name = Saud Khan

ID = 7774

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Submitte to Engr- Abdul Farhan

Q1 Ans

Sol

①

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

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

$$\phi = \alpha + \beta = 90^\circ$$

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

$$KT_1 = KN = R_s \tan\left(\frac{\alpha}{2}\right) \\ = 7474 \tan\left(\frac{50^\circ}{2}\right)$$

$$KT_1 = 3485.183 \text{ m}$$

$$MN = MT_2 = R_L \tan\left(\frac{\beta}{2}\right)$$

$$= MN = 2756.710$$

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$$KM = MT_2 + KT_1$$

$$KM = 6241.893$$

Find  $\Delta BKM$  by sine rule

$$\frac{BK}{\sin \beta} = \frac{MK}{\sin(I)}$$

$$BK = \frac{MK \sin \beta}{\sin(I)}$$

$$= \frac{6241.893 \sin(40^\circ)}{\sin(90^\circ)}$$

$$BK = 4012.211$$

$$BM = \frac{MK \sin \alpha}{\sin(I)}$$

$$= \frac{6241.893 \sin(50^\circ)}{\sin(90^\circ)}$$

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$$BM = 4781.567$$

$$T_L = KT_1 + BK$$
$$= 3485.183 + 4012.211$$

$$T_L = 3485.183 + 4012.211$$

$$T_L = 7497.394$$

$$T_S = MT_2 + BM$$

$$T_S = 2756.710 + 4781.567$$

$$T_S = 7538.277$$

$$L_L = \frac{\pi R_L \alpha}{180} = \frac{\pi 7574 (50^\circ)}{180}$$

$$L_L = 6609.561$$

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$$L_s = \frac{\pi R s P}{180} = \frac{\pi 7474 (40)}{180}$$

$$L_s = 5217.836$$

Change of intersection point

—  $T_L$

$$7374 - 7497.394$$

$$\text{Change of } T_1 = -123.394 \text{ m}$$

change of  $T_1 + L_s$

$$= -123.394 + 6609.561$$

$$= 6486.167$$

change of compound curvature (N)

plus  $L_s$

$$6486.167 + 5217.836$$

$$\text{Change of } T_2 = 11704.003$$

Q 2 Ans

A curve of varying radius is called a transition curve it is also called spiral curve or Easement curve

→ it is used on both highway & railway b/w tangent and a ~~curve~~ circular curve in order to have smooth transition from tangent to the curve and from curve to the tangent it is also insert b/w two branches of compound curve.

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## Super Elevation:-

when vehicle move from tangent on to the curve the forces acting on it are

- weight of the vehicle

- centrifugal force, Both acting through the center of gravity of the ~~vehicle~~ vehicle.

The effect of the centrifugal force is to push the vehicle off the road or road.

To counter act the action the outer road or outer edge of the road is raised above the raising of outer edge of road or road above the inner one is called super elevation or cant

The amount of super elevation  $\phi$  depend upon

- speed of vehicle
- Radius of the curve

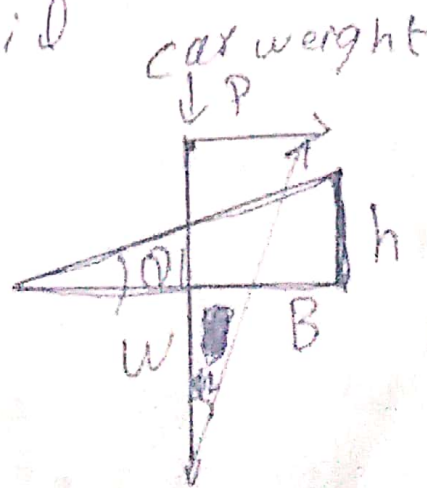
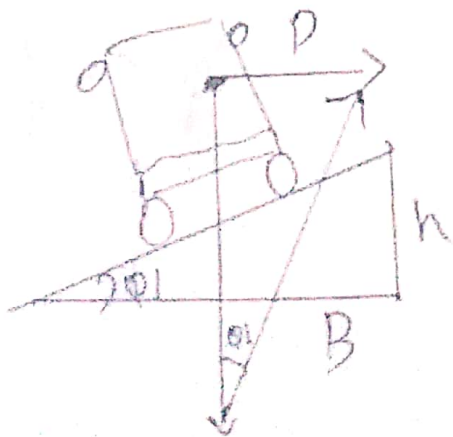
$$P = \frac{mv^2}{R} = \frac{wv^2}{gR} \quad \therefore w = mg$$

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

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

$$h = \frac{bGv^2}{g\delta} \quad \text{--- on railway}$$

where  $G =$  Distance b/w the centre of rail





## Triangulation

① All angles are measured in triangulation

② Distance of baseline is measured to control scale error

③ Some check base line are also measured to control scale error

④ Intervisibility b/w station 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

## Trilateration

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 check in comparison with triangulation in the same geometric figure

⑥ The angle are computed on the basis of measure side length applying cosine law

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## Principle of triangulation

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

Sine Rule  $\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$

OR  $\frac{\sin A}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$

# Trilateration (10) and its Principles :-

- Trilateration is a highly accurate 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 the three sides of each triangle are measured in the field with the distance measuring instrument (EDMs, tapes other apparatus)
- Horizontal angles are not measured in field
- Angles in a trilateration system are computed indirectly from the length of the side of triangle by cosine formula.
- few horizontal angle are also sometimes measured to provide a check on computed angles
- Trilateration is adjusted after the computing of the angles and the co-ordinates of the station are determined.

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• vertical angles are also measured where elevation have not been established

cosine Rule

$$① a^2 = b^2 + c^2 - 2bc \cos A$$

$$② 2bc \cos A = b^2 + c^2 - a^2$$

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

~~A cos~~

## Q4 Ans: Hydrographic surveying

→ it is the branch of surveying which deal with water bodies e.g lake, rivers etc.

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

- ① water volume
- ② Rate of flow
- ③ To determine the shape of the area underlying the water surface etc.

→ Hydrographic surveying :-

- ① preparation of accurate chart for navigation.
- ② Determination of the quantities of material to be filled
- ③ obtaining information for design of breakwaters, sea wall etc.

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## Hydrographic survey conducting:

- ① Prepare for survey. before beginning, make sure all the equipment is ready to go
- ② Run straight line. Track line are very important especially when using single-beam systems
- ③ Go the distance
- ④ Process data right away

The primary purpose of hydrographic surveying is the water depth, Harbor and port survey are conducted to determine ideal.

Q4

(b) Sounding

- ① The process of ~~sounding~~ determining depth below the water surface is called sounding.
- ② Sounding is analogous to levelling on land.
- ③ The reduced level of any point on the bottom of a water body is obtained by subtracting the sounding from the mean sea level.

Purpose of sounding

- ① Preparation of accurate charts for navigation.
- ② Determine of the quantities of material to be filled.
- ③ Obtaining information for design of breakwaters, sea, well etc

Equipment

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of sounding

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The essential equipment and instrument employed for taking the Sounding may be grouped as:

- ① Shore signal and buoys
- ② Sounding equipment
- ③ Angle measuring instruments



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Q5 <sup>Ans</sup> ⇒ Aerial photography is taking of photographs from an aircraft or other flying object. platform for aerial photography include fixed-wing aircraft, helicopters, unmanned aerial vehicles, balloons, blimps and dirigibles, rockets, pigeon, kites, parachutes, parachutes, stand-alone telescoping and vehicles mounted poles.

→ Aerial photography is used in cartography, land-use planning, archaeology, movie production, environmental studies, espionage, commercial advertising, conveyancing and other fields.

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Q5b Ans

A photogrammetric mapping process includes: obtaining<sup>in</sup> aerial photography, completing ground control networks, constructing map from photos, checking the compiled map data for compliance with project specification. The ground control points to be measure by photogrammetry should be signalled before the flight.