

Name = Khalid Khan

ID = 7936

Section = B

Paper = Advance
Surveying.

Submitted to = Engr- Sir Farhan

Question # 1:-

Transition Curve:-

A curve of varying radius is called transition curve & blue tangent and a circular curve at is also known as spiral curve - at can be inserted in blue the two branches of a compound of reverse curve.

Types:-

These are three common types of transition curves which are given below-

- i) Cubic parabola -
- ii) Clothoid or spiral -
- iii) Lemniscate:-

Superelevation:-

~~It is~~ the amount by which the outer edge of a curve on a road or railways is banked above the inner edge

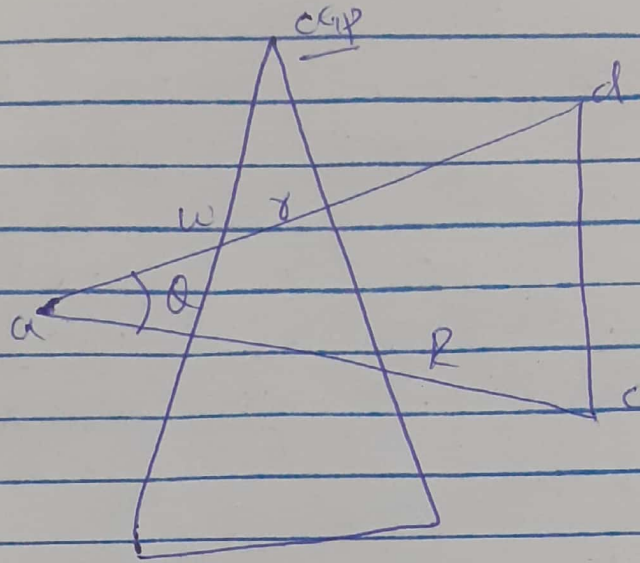
~~which~~ when a vehicle passes to a curved path, the following forces acts on it

- ⇒ weight of vehicle
- ⇒ centrifugal force both acting through centrifugal of gravity of vehicle.

Effects:-

The effects of ~~centrif~~ centrifugal force is the push the vehicle off the track. Now to counteract the action the plane of the road surface is made perpendicular to resultant of centrifugal force and weight of vehicle. In other words, the outer bank of road is raised above the inner one. The raising of outer bank over the inner one is known as super elevation.

⇒ Mathematically:-



w = weight of vehicle

p = Centrifugal force

v = Speed of vehicle

g = acceleration due to gravity.

R = radius of curve.

h = Super elevation in m.

b = width of road in m.

G = Distance b/w centre of
axles.

For Equilibrium:-

The resultant of weight and centrifugal force must be equal and opposite to the reaction perpendicular to road.

As we know that --

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

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

gt θ is the inclination of road surface, the inclination of resultant to vertical is also g

So we have

$$\tan \theta = \frac{dc}{ac} = \frac{P}{w} = \frac{b v^2}{gR}$$

\Rightarrow on roads:-

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

\Rightarrow on Railways:-

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

P.T.O

Radius:-

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

$$R = \frac{v^2}{b \tan \theta g} \quad (\text{for roads})$$

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

$$R = \frac{Gv^2}{b \tan \theta} \quad (\text{for railways})$$

Speed of vehicles:-

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

$$v^2 = b \tan \theta g R$$

$$v = \sqrt{b \tan \theta g R}$$

(for roads)

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

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

$$v = \sqrt{\frac{b \tan \theta g R}{G}}$$

(for railway)

Question = 2 :-

Triangulation:-

Triangulation 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.

Principle of triangulation:-

⇒ 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.

⇒ 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.

Trilateration:-

⇒ Method in which the lengths of all sides of chain of triangles, polygons or quadrilaterals are measured ~~with~~ with an electronic instrument. However, the angles may be computed from these field measurements.

⇒ Uses in the construction of a chain or network of interconnected triangles in a given area and the measurement of all three sides of each triangle.

Principle of Trilateration:-

⇒ Trilateration is a highly accurate and 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 triangles are

measured in the field with the distance measuring instrument -

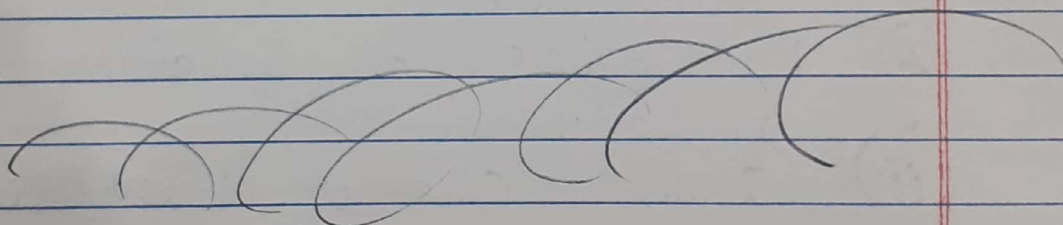
Horizontal angles are not measured in the field
Vertical angles are also measured where elevations have not been established.

Difference b/w Triangulation vs Trilateration:-

Triangulation :-

- i) All angles are measured in triangulation.
- ii) Distance of baseline is measured.
- iii) Some check base lines are also measured to control scale error.
- iv) intervisibility b/w stations is essential.
- v) There are more internal check in comparison with trilateration in the same geometrical figure.

Triilateration:-

- i) All sides are measured in triilateration -
 - ii) Azimuth of the initial line is measured -
 - iii) Some check angles are measured to control azimuth error -
 - iv) For small areas it is possible to measure distance without intervisibility.
 - v) The angles are computed on the basis of measured side length applying cosine law -
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Question = 3 :-

Part = A ✓

Hydrographic Survey:-

Hydrographic Survey or bathymetric Surveying is the survey of physical features present under water that effect all the marine activities like dredging, marine construction, offshore drilling etc.

Hydrographic Surveying is mainly conducted under authority concern. It is mainly carried by means of sonar, sounding or electronic sensor system for shallow water.

Why we do Hydrographic Surveying:-

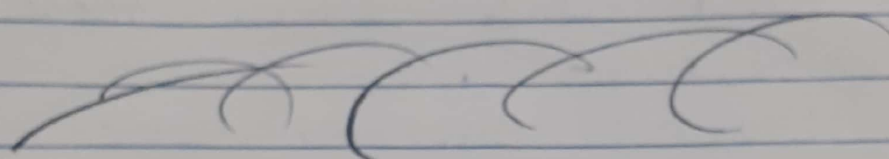
In order to get following information we do hydrographic surveying.

- ⇒ Depth of bed can be determined-
- ⇒ Shore lines can be determined.
- ⇒ Locating sewer fall by measuring direct current-
- ⇒ Locating mean sea level
- ⇒ Tide measurement-
- ⇒ River and Stream discharge measurement-
- ⇒ Massive structures like bridges dams harbors are planned.

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.
- C) Issue to a designated unit-
- D) Programme planning of that unit-

- e) Assessment of the task with in that unit.
 - f) Reconnaissance requirements.
 - g) Resource allocation
 - h) Detailed Survey planning.
 - i) Plans for completion and checking of data.
- 

Question = 3:-

Part = B:-

Sounding:-

- ⇒ The process of determining depths the water surface is called sounding.
- ⇒ Sounding is analogous to levelling on land.

Purpose of Sounding:-

- ⇒ Preparation of accurate charts for navigation.
- ⇒ Determine of the quantities of the material to be filled.
- ⇒ Obtaining information for design of breakwaters, sea wall etc.

Name of equipment

for sounding:-

- ⇒ The essential equipment and instrument employed for taking the sounding may be grouped as:
- 1) Shore signals -
 - 2) Sounding equipment -
 - 3) Angle measuring instruments.

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Shore Signal & buoys:-

Shore signal are required to mark range lines.

⇒ Each range line is marked with ~~two~~ two signals at some distance apart along it one each shore.

⇒ The signals are usually wooden tripods with a white and coloured flag on the top.

Sounding Equipment:-

1) Sounding boat:-

⇒ The sounding operation is carried out from a flat bottom boat of low draft.

⇒ The boats are generally provided with opening, called wells through which soundings are taken.

2) Sounding pole:-

⇒ These are made of strong well seasoned timber usually 5 to 10cm in diameter and 5 to 10cm in length.

⇒ The sounding rods consists of two or three length

screwed together so that unnecessary length may be removed when not required in shallow water.

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Lead line

Weddell sounding machine

Echo sounding machine.

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Angle measuring Equipment:-

Most common angle measuring instrument are:

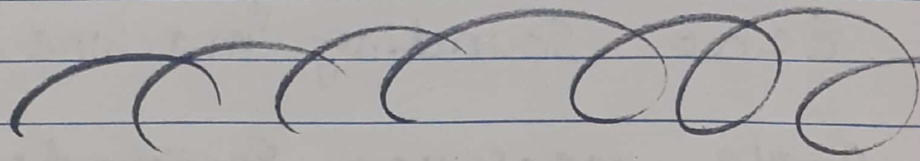
- 1) Theodolite
- 2) Prismatic compass
- 3) Sextant.

The theodolite and prismatic compass are not suitable for angle measurement from sounding boats due to instability of rowing boats.

Equipment:-

- 1) Index glass -
- 2) Index Arc -
- 3) Horizon glass -
- 4) Pin hole plate -
- 5) Ring carrying telescope -
- 6) Arc -
- 7) Vernier -
- 8) Clamp

- a) Tangent screw-
- 10) Reading glass
- 11) Handle



Question = 4:-

Part = A:-

Aerial photography

Aerial photography is the branch of surveying that deals with production of maps such as planimetric or topographic maps by comparing number of photographs taken in that area.

Ob Aerial photography is the taking of photographs from above with a camera mounted or hand held on an aircraft helicopter, balloon, rocket, kite, skydiver or similar vehicle.

Why do it:-

- ⇒ The use of aerial photograph for military purposes was expanded during world war "I" by aviators.
- ⇒ Aerial photography is used

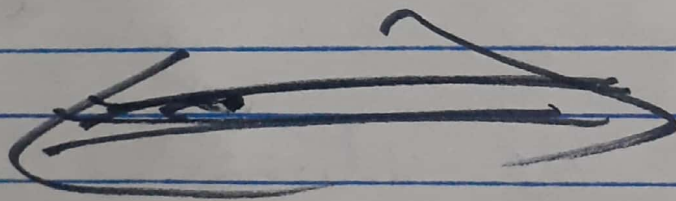
in cartography, land use planning, archeology, movie production, environmental studies, espionage, commercial advertising, conveyancing and other fields.

Types:-

- i) Terrestrial photogrammetry -
- ii) Aerial photogrammetry -

Terms used in ~~areal~~ aerial photography:

- ⇒ Exposure station -
- ⇒ Flying height -
- ⇒ Altitude -
- ⇒ Tilt -
- ⇒ Swing -



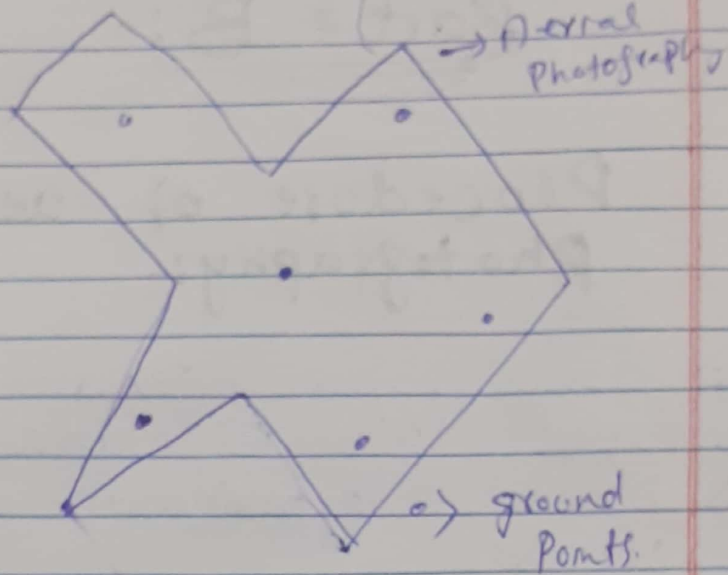
Question = 41-

Part = B:-

Procedure of aerial photography:-

- ⇒ Establishing central points
- ⇒ flight planning and photography
- ⇒ Photo interpretation and stereoscopy.
- ⇒ Parallax and measurement of parallax.
- ⇒ Construction of map and cartography.

These should be maximum of 3 to 4 central points are need in one photograph. The establishment of central points depends upon the scale at map, flight central and cartographical method of mapping.



Ground Facts:-

- ⇒ Area to be Surveyed.
- ⇒ focal length of camera.
- ⇒ overlap.

