GOVERNMENT POLYTECHNIC BALASORE

DEPARTEMENT OF CIVIL ENGINEERING

LECTURE NOTE

SUBJECT:- LAND SURVEY-II

PREPARED BY:- BIKASH KUMAR PATRA

SEMISTER:- 6TH

MODULE - 1

1. Determine the constant of a tachometer form the following taken with its. (Tangential method).

Distance to staff from tachometer vertical axis.	Reading against stadia wires	
	lower wire	upper wire
30m	1.086 m	1.383 m
60 m	0.924 m	1.521 m

Tachometry $D = ks + c$

D = Distance

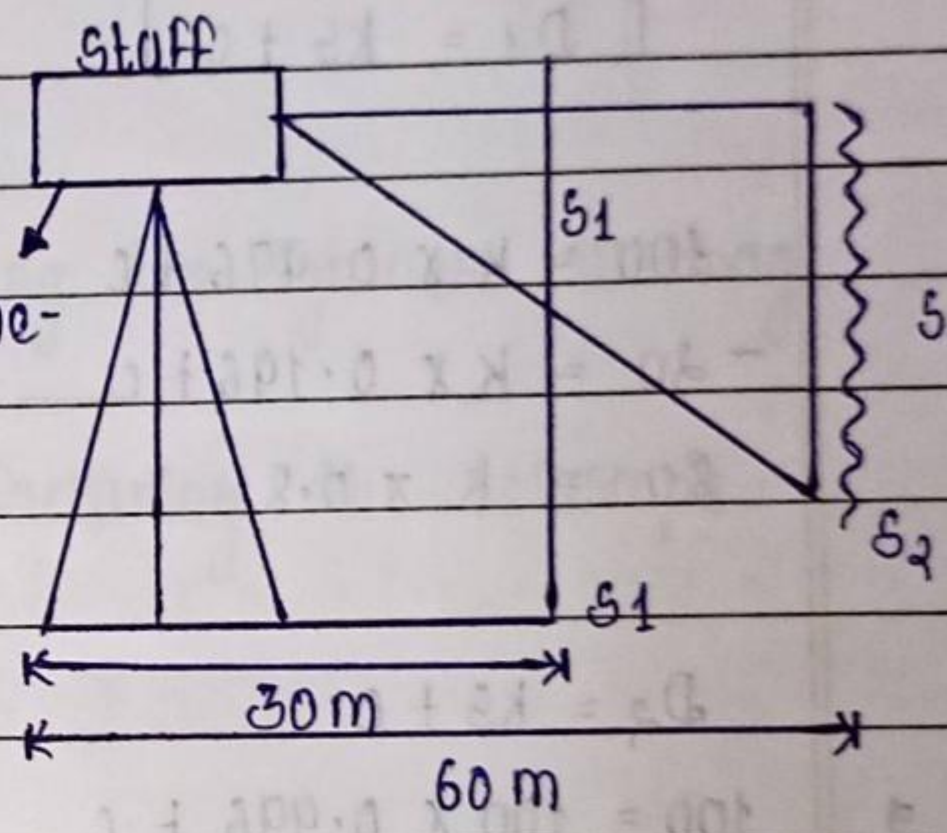
C = constant

S = staff..

$k = \frac{f}{i}$

where f = focal length

i = stadia hair



$d_1 = 30$ m

$d_2 = 60$ m

$S_1 = THL - LHL = 1.383 - 1.086 = 0.296$

$S_2 = THL - LHL = 1.521 - 0.924 = 0.597$

$K = \frac{f}{i}$ $f = 60$

$i = \frac{S_1 + S_2}{2} = \frac{0.296 + 0.597}{2} = 0.446$

We know that $D = ks + c$

$60 = \frac{60}{0.446} \times 0.296 + 0.597 + c$

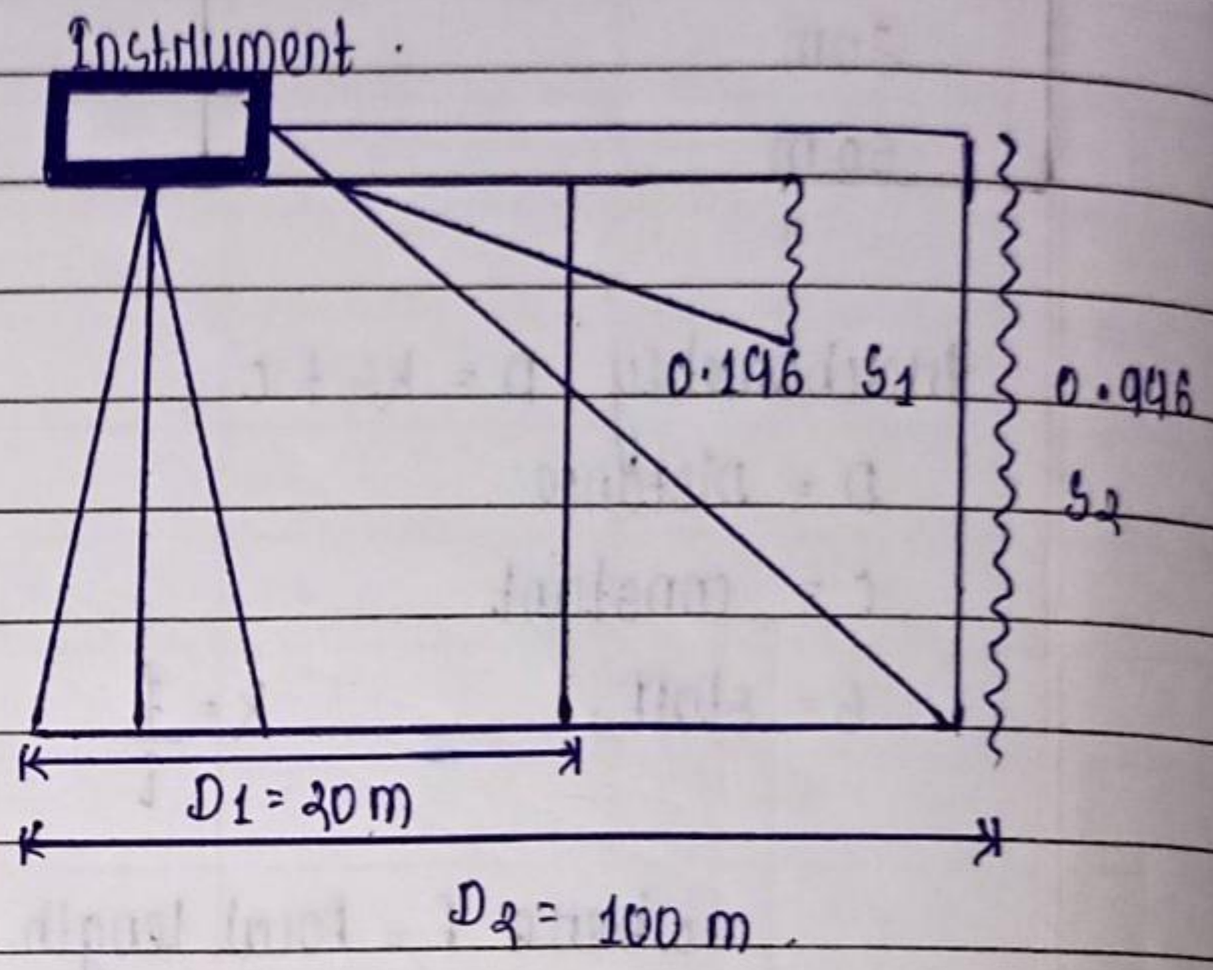
$C = 60 - \frac{60}{0.446} \times 0.296 + 0.597$

$C = -60.$

2. Two distance of 20 m and 100 m where accurately measure out and the intersect on the staff between the outer stadia waves were 0.196 m at the former distance and 0.996 m at the letter. calculate the trachometric constant. (Distance angle).

$D_1 = 20$ m
$D_2 = 100$ m
$S_1 = 0.196$ m
$S_2 = 0.996$ m

$D = kS + C$



subtracting

$D_2 =$	$kS + C$
$D_1 =$	$kS + C$

$100 = k \times 0.996 + C$
$- 20 = k \times 0.196 + C$
$80 = k \times 0.8$

$\Rightarrow k = \frac{80}{0.8} = 100$

$D_2 = kS + C$
$\Rightarrow 100 = 100 \times 0.996 + C$
$\Rightarrow 100 - (100 \times 0.996) - C$
$\Rightarrow 100 - 99.6 = C$
$\Rightarrow 0.4 = C$

$C = 0.4$

Anallactic lens → A concave lens specially provided in a telescope between the object lens and eyp to elliminate the addictive constant (f+d) form trachometric distance equation is known as anallactic lens.

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Advantages of anallactic lens :-

The main advantages of anallactic lens are :-

i. By the introduction of anallactic lens the calculation of distance and the height is very much simplified if the multiplying constant is 100 and additive constant is zero the horizontal distance is obtained by simple multiplying the staff intersect is 100.

ii. The anallactic lens is sealed against moisture or dust.

iii. The loss of sight can be compensate for by the use of straight large object glass.

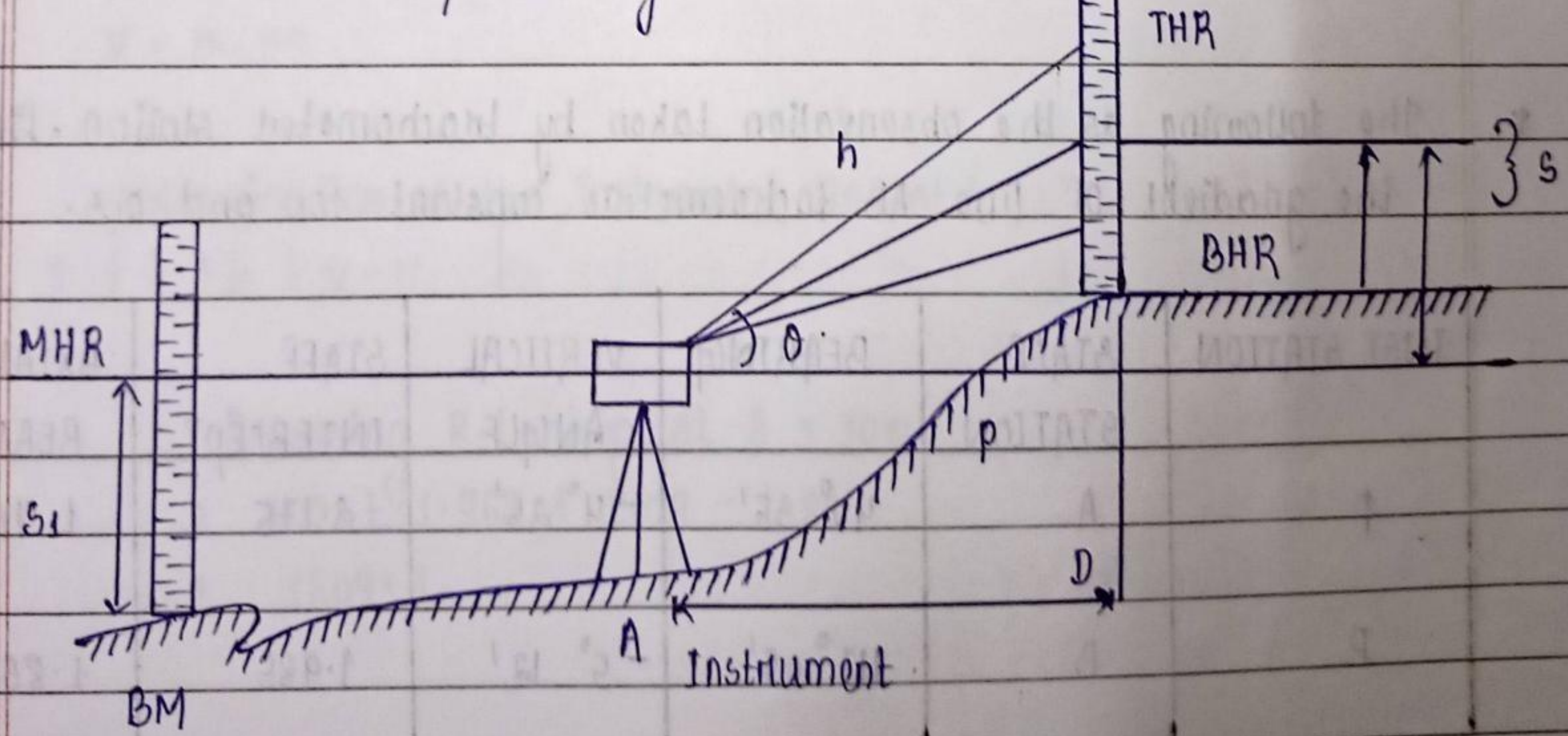
Disadvantages of anallactic lens :-

i. It increases absorption of light, decreasing the lightness of image.

ii. It also add to the initial cost of manufacturing the telescope.

iii. It cannot be cleaned easily.

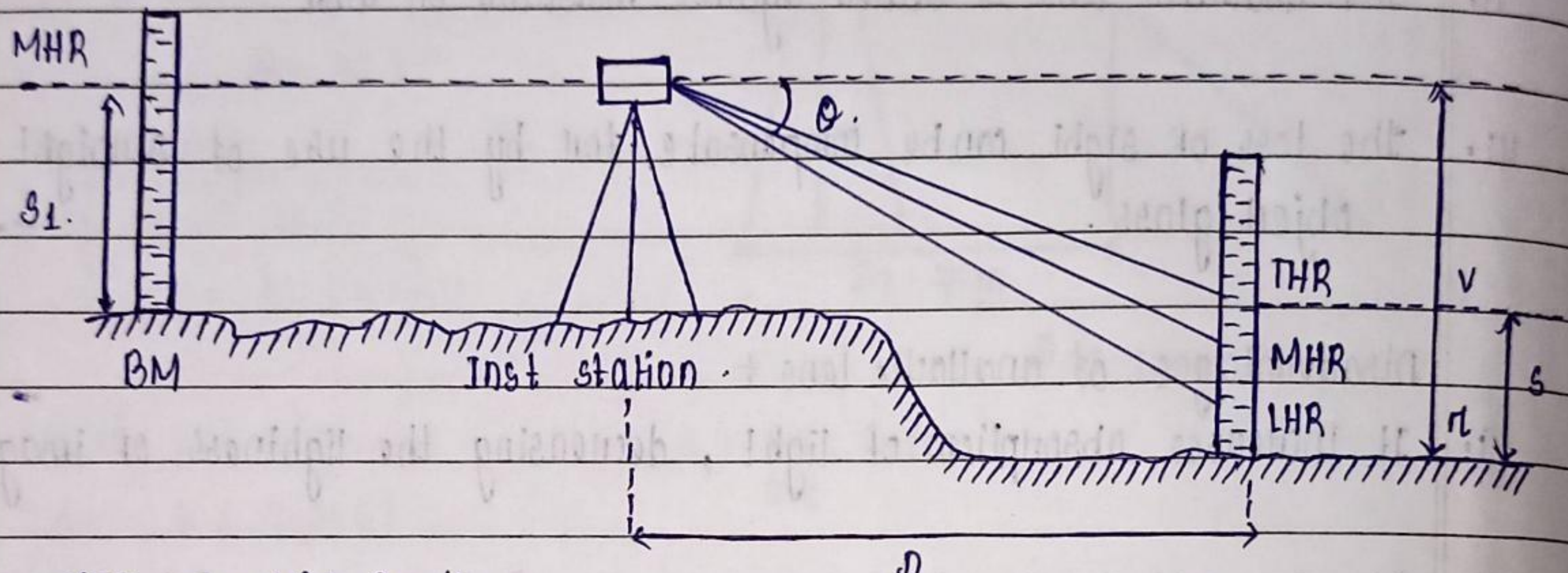
iv. In case of adjustable it is a potential source of error unless proper field chain is made periodically.



: $D = ks \cos^2 + c \times \cos\theta$.
: $V = ks \frac{\sin\theta}{2} + c \times \sin\theta$.

BM = Bench Mark
TBM = Temporary Bench mark
↓ Tree or a fixed point.

R.L → Mean sea level or Reduced level
or Dattum level. Karachi (pakistan).

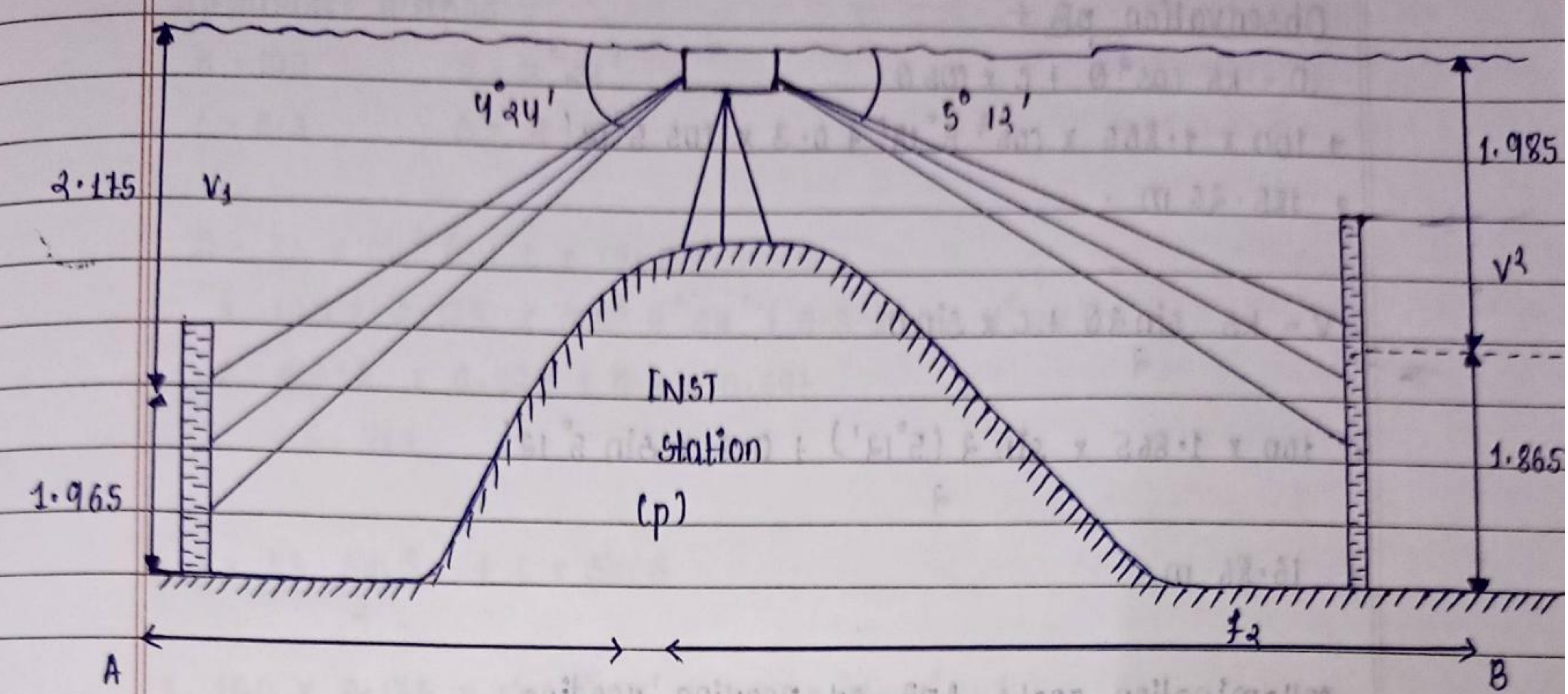


THR → Top Hair Reading.
MHR → Mid Hair Reading.
LHR → Lower Hair Reading.
BM → Bench Mark.
R → Reduced level.
V → vertical distance.

$D = ks \times \cos^2\theta + c \times \cos\theta$
$V = ks \frac{\sin\theta}{2} + c \times \sin\theta$.

* The following as the observation taken by trachometer station. Find the gradient of line AB tachoemetric constant 100 and 0.5.

INST STATION	STAFF STATION	BEARING	VERTICAL ANGLE	STAFF INTERCEPT	AXIAL HAIR READING.
P	A	40° 35'	−4° 25'	2.175	1.965
P	B	117° 05'	−5° 12'	1.985	1.865



Solution:- $K = 100$

$C = 0.3$

$\theta = 4°24'$

$S = 1.965$

$D = KS \cos^2\theta + C \times \cos\theta$.

$D = 100 \times 1.965 \times \cos^2 4°24' + 0.3 \times \cos 4°24'$

$D = 195.6201$.

$V = KS \frac{\sin\theta}{2} + C \times \sin\theta$

$\Rightarrow 100 \times 1.965 \times \frac{\sin 2 \times 4°24'}{2} + 0.3 \times \sin 4°24'$

$V = 15.09$.

collamination of the instrument line at A

$\Rightarrow$ $A + h + V - r$

Assuming R.L at point A = 100

$\Rightarrow 100 + 1.965 + 1509 - 1.865$

$\Rightarrow 1609.1$.

Observation pB ÷

$D = KS \cos^2\theta + C \times \cos\theta$

$\Rightarrow 100 \times 1.865 \times \cos^2 5°12' + 0.3 \times \cos 5°12'$

$\Rightarrow 185.26$ m.

$V = KS \frac{\sin 2\theta}{2} + C \times \sin\theta$

$\Rightarrow 100 \times 1.865 \times \frac{\sin 2(5°12')}{2} + 0.3 \times \sin 5°12'$

$\Rightarrow 16.86$ m.

collamination angle APB or Bearing reading

$\Rightarrow 117°05' - 40°35'$

$\Rightarrow 76°30'\ \theta$.

point B

$P = A - V_2 - r$

Applying cosin formula

$P^2 = PA^2 + PB^2 - 2 \times PA \times PB \cos\theta$

$\Rightarrow 195.62^2 + 185.26^2 - 2 \times 195.62 \times 1.8562 \cos\theta$

$\Rightarrow 194.65$.

Gradient = $\frac{1}{b/w \times \text{distance between AB}}$

$\Rightarrow \frac{1}{\frac{194.65}{18.78}} = 0.0964$.

b/w = fixed pl − p

$\Rightarrow 100 - 81.217 = 18.783$.

Alternative method ÷

$K = 100 \qquad \theta = 4^\circ 24'$

$C = 0.3 \qquad S = 2.175$

$D = KS \times \cos^2\theta + C \times \cos\theta$

$\Rightarrow 100 \times 2.175 \times \cos^2 4^\circ 24' + 0.3 \times \cos 4^\circ 24'$

$\Rightarrow 217.5 \times 0.994 + 0.3 \times 0.997$

$\Rightarrow 216.489$

$V = KS \dfrac{\sin\theta}{2} + C \times \sin\theta$

$\Rightarrow 100 \times 2.175 \times \dfrac{\sin 4^\circ 24'}{2} + 0.3 \times \sin 4^\circ 24'$

$\Rightarrow 100 \times 2.175 \dfrac{\sin 2\, 4^\circ 24'}{2} + 0.3 \sin (4^\circ 24')$

$\Rightarrow 16.53 + 0.023 = 16.553$

collamination of the instrument line at A·

$\Rightarrow A + h + V - r$

Assuming R·L at point A = 100

$P = A + V - r \Rightarrow 100 + 16.553 - 1.965$

$\Rightarrow 114.588$

Observation from PB ÷ $D = KS \cos^2\theta + C \times \cos\theta$

$\Rightarrow 100 \times 1.985 \times \cos^2 5^\circ 12' + 0.3 \times \cos 5^\circ 12'$

$\Rightarrow 197.168$

$V = KS \dfrac{\sin 2\theta}{2} + C \times \sin\theta$

$\Rightarrow 100 \times 1.985 \dfrac{\sin 2\,(5^\circ 12')}{2} + 0.3 \times \sin 5^\circ 12'$

$\Rightarrow 17.892$

collamination angle ApB or Bearing reading of RA

→ 117° 05' − 40° 35'

→ 76° 30' θ.

point at B ÷ p = A − V₂ − r

→ 100 − 17.842 − 1.865

→ 80.243

According to cosine rules

$AB^2 = pA^2 + pB^2 - 2\,pA \times pB \times \cos\theta$

→ $(216.51)^2 + (197.168)^2 - 2 \times 216.51 \times 197.168 \times \cos 76°30'$

→ 85751.800 − 19931.02

→ 65820.78

$AB = \sqrt{65820.78} = 256.555$

Gradient of AB = $\frac{1}{\text{distance between AB}}$

→ $\frac{1}{256.555} = 3.89 \times 10^{-3}$.

MODULE − 2 CURVE

1. Simple curve.
2. compound curve.
3. Reverse curve.
4. Transitional curve.

* Different part used with short circular curve.

collamination angle ApB or Bearing Heading of RA

$= 117°05' - 40°35'$

$= 76°30'\ \theta$

point at B ÷ $p = A - V_2 - h$

$= 100 - 17.842 - 1.865$

$= 80.243$

According to cosine rules

$AB^2 = pA^2 + pB^2 - 2\,pA \times pB \times \cos\theta$

$= (216.51)^2 + (197.168)^2 - 2 \times 216.51 \times 197.168 \times \cos 76°30'$

$= 85751.800 - 19931.02$

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Module - 2 CURVE

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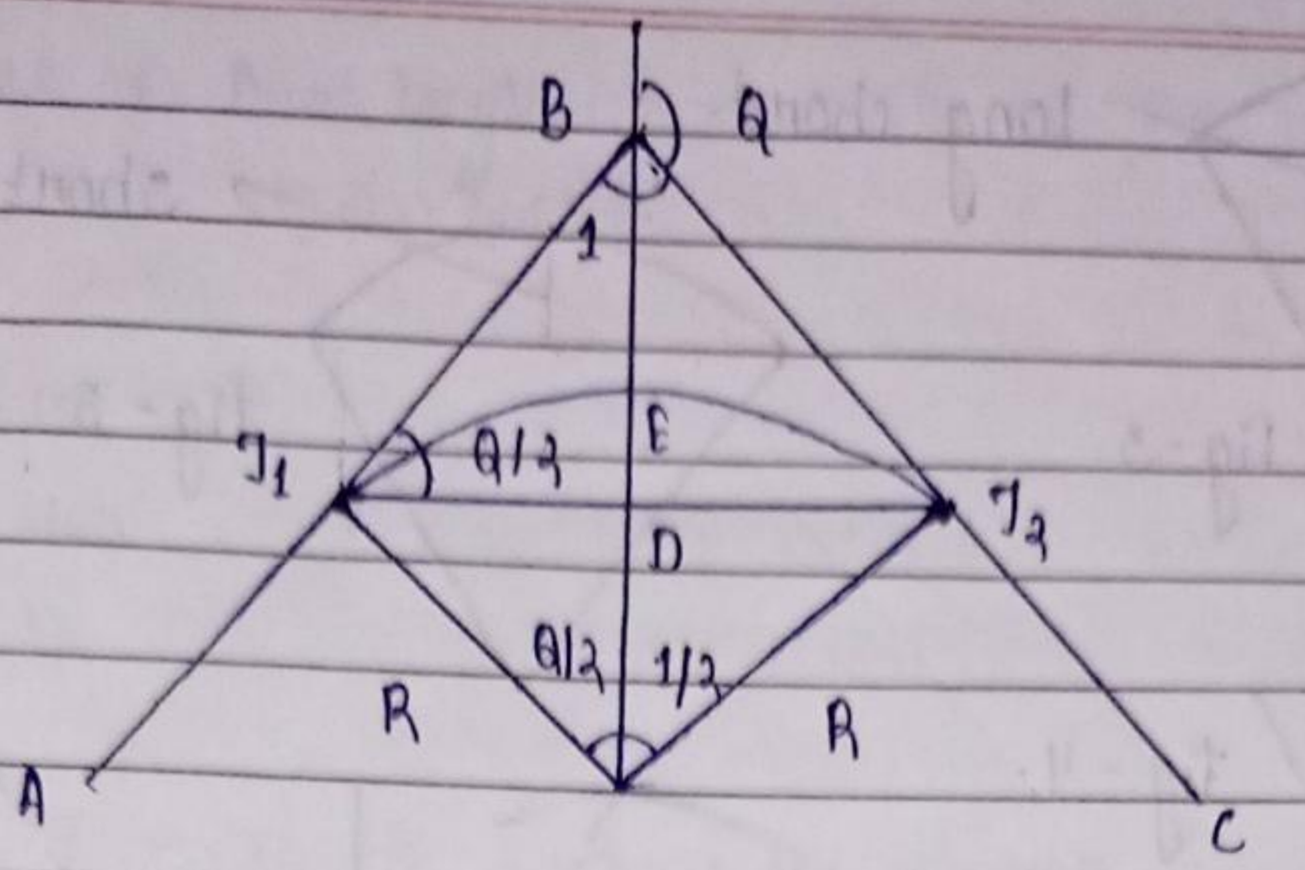
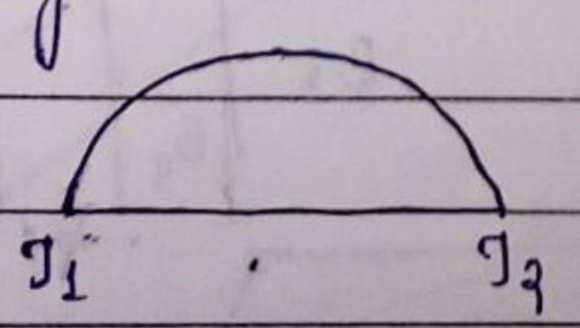
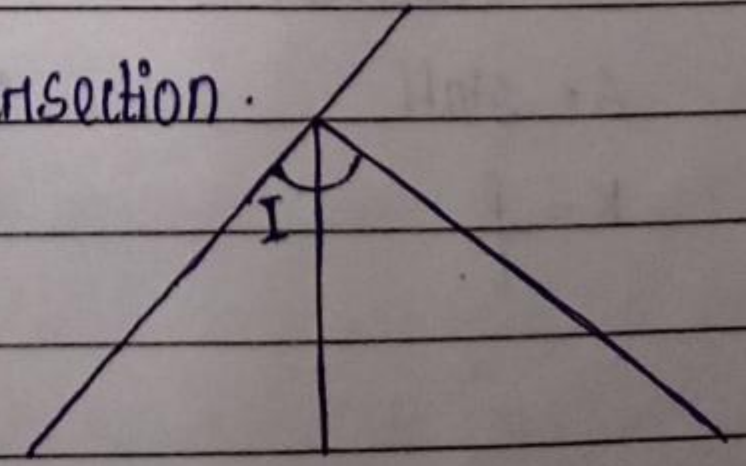


- AB and BC are known as tangent of the curve.
- B is known as the point of intersection or vertex point.
- The angle θ is known as angle of deflection.
- The angle I is called as angle of intersection.
- point T_1 and T_2 are known as tangantial point.
- Distance between BT_1 and BT_2 are known as tangent length.
- When the curve reflected to the right it is called as right hand curve, when it is reflected to left it is said to left hand curve.
- AB is called the rear tangent and BC the forward tangent.
- The straight line $T_1 D T_2$ is known as long cord.
- The curve line $T_1 E T_2$ is said to be the length of the curve.
- The midpoint E of the curve $T_1 E T_2$ is known as apex or summit of the curve.
- The distance DE is called versed sime of the curve.
- R is the radius of curve.
- The angle $T_1 O T_2$ is equal to deflection of angle θ.
- The point T_1 is known as beginning of the curve or the point of curve.
- The end of the curve T_2 is known as point of tangensi.

Tangent



Intersection.



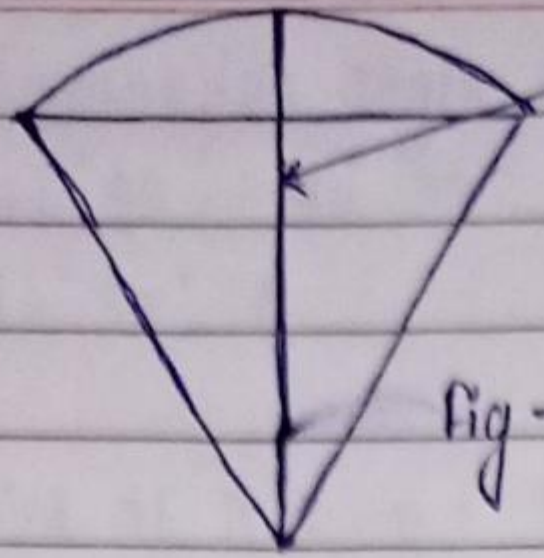


fig-3.

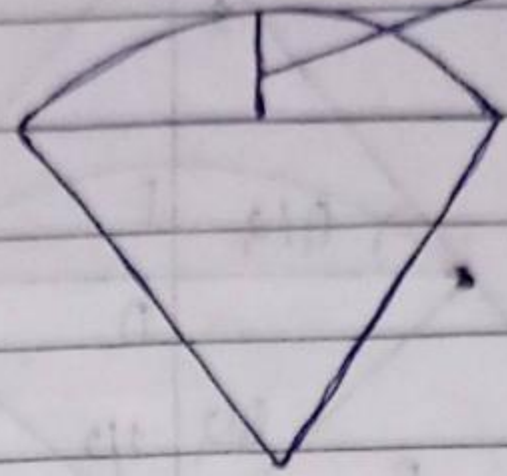


fig-5

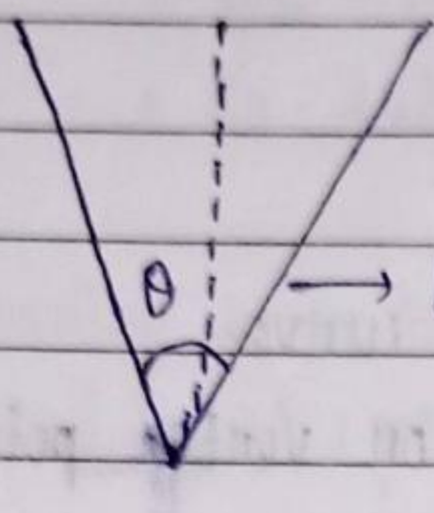


fig-4.

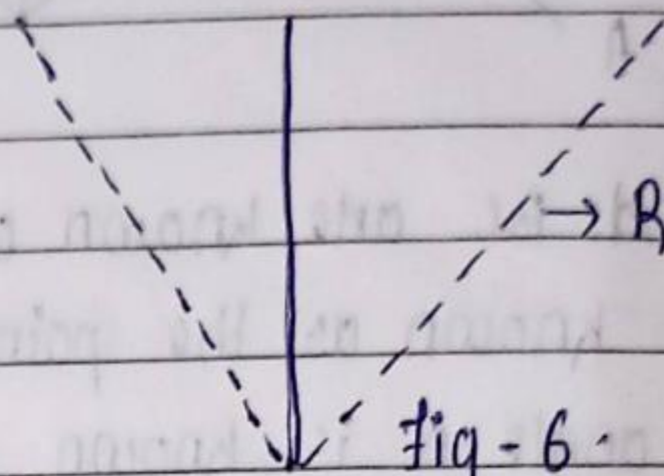


fig-6

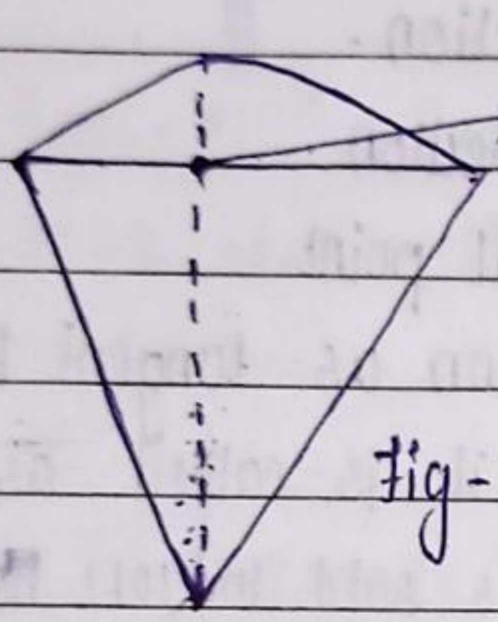


fig-7.

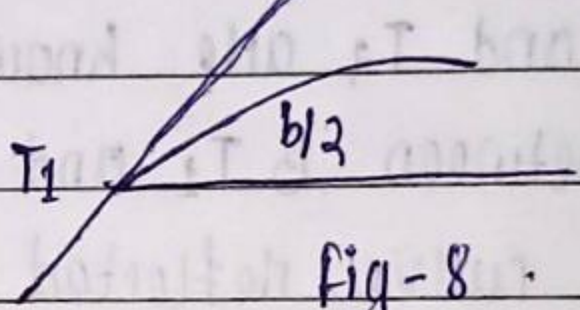


fig-8

To determine the value of stadia hair constant from the following observation.

Instrument station.	staff reading	Distance (m)	Stadia Reading.	
			lower	upper
O	A	150	1.255	2.750
	B	200	1.000	3.000
	C	250	0.750	3.255

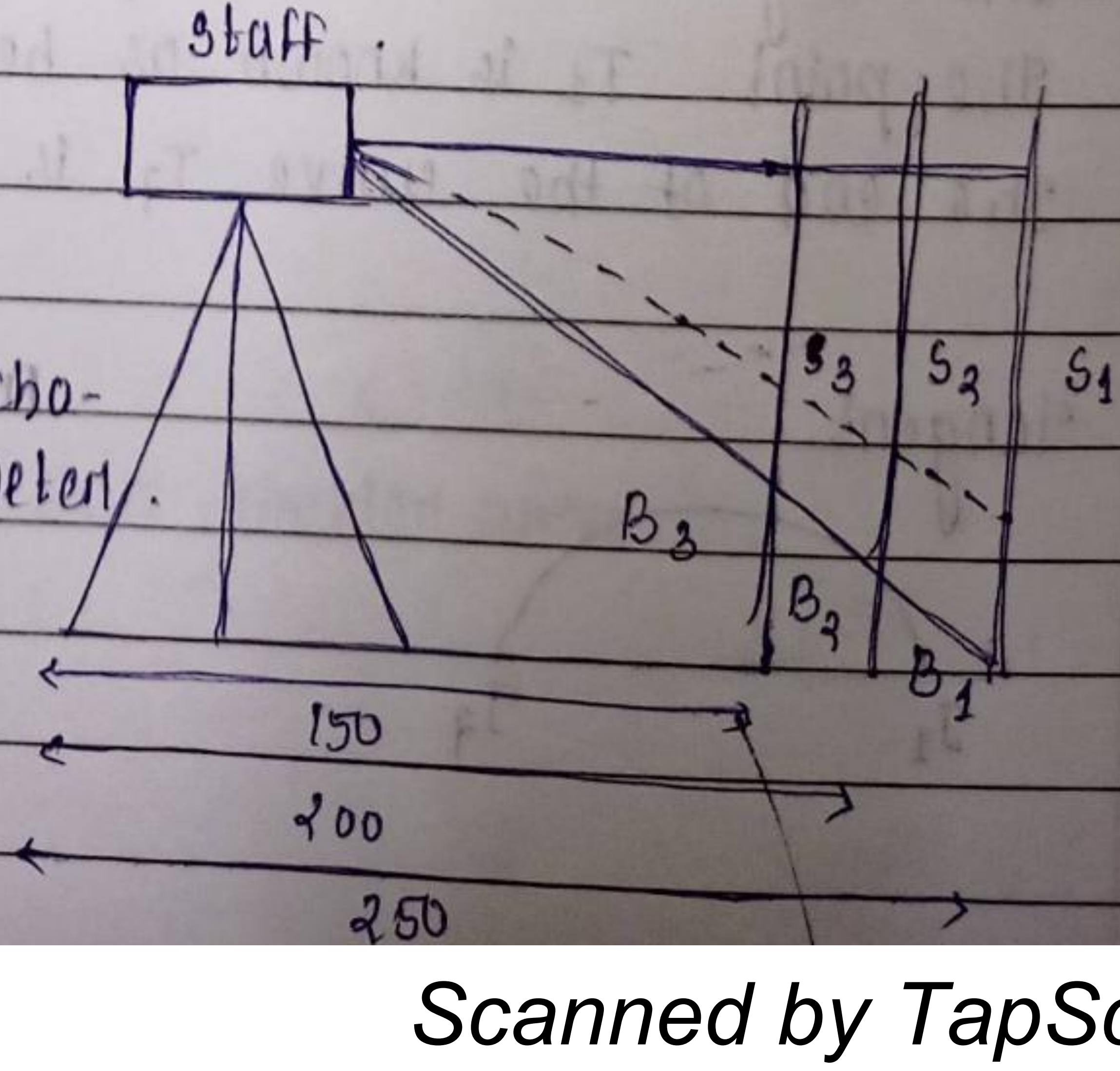
Tracheometry $D = ks + c$

D = Distance

C = constant

S = staff

$k = \frac{f}{i}$



Transitional curve → A non circular curve of varying radius introduce between a and a circular curve for the purpose of even easy change of direction of a route is called as transition or accessment curve.

It is also insert between branches of compound and reverse curve.

Advantages of providing an transitional curve at each and of a circular curve.

1. The transitional curve from the tangent to the circular curve and from the circular curve to tangent is made gradually.
2. It is provided satisfactory means of obtain a gradual increase of super elevation from zero on the tangent to the required full amount on the main curve.
3. of side skadding or overturning of vehicle is eliminated.
4. Discomfort to passengers is eliminated.

condition to fulfill by the transitional curve.

A cubic parabolic, it should meet the tangent knife as well as the circular curve tangentially.

The rate of increase of curvature along the transmission curve should be the same of d that of the increasing elomination.

The length of transitional curve should be such that the fulfill super elevation in attention at the circular curve.

It is radius at junction to the circular curve should be equal to that of a circular curve.

There are three type of transitional curve is known as common use of curve.

1. A cubic spiral
2. cubic parabolla.
3. lemmiscate.

The first two are used on railway and highway both, while the third on highway only.

When the transition curve introduced at each end of the main circular curve, the combination thus obtaining is known as combined curve.

SUPERELEVATION OR CANT

The definite rate of superelevation is adopted as in one in 'n', the value of n varying from 300 to 1000.

Length of transitional curve $L = \frac{nh}{100} \times m$ where h = amount of superelevation in cm.

Ex → calculate the length of transition curve required in order to attend a maximum superelevation of 15 cm assuming the rate of superelevation to be 1 in 400 hence length of transitional curve

$$l = \frac{400 \times 15}{100} m = 60 m.$$

By considering the orbitary time rate of superelevation $L = \frac{h \times v}{x}$

where h = amount of superelevation v = speed in metre per second

x = time rate in cm per sec.

its varies from 2.5 to 5 (cm per second).

calculate the length of transition curve to attend a maximum superelevation of 15 cm assuming a rate of superelevation of 3 cm per second, the speed of the vehicle is 50 km/hr.

$$L = \frac{h \times v}{x}$$

$$V = \frac{50 \times 1000}{60 \times 60} = \frac{500}{36} m/s = 13.88$$

$h = 15$ cm. $\quad L = \frac{h \times v}{x} = \frac{15 \times 13.88}{3} = 69.44$ m.

$x = 3$

considering rate of change of radial acceleration of circular curve = $\frac{V^2}{R}$ time taken by vehicle to cover transitional curve $\frac{L}{V} \times s$. — ①

again if k = m/sec be change of radial acceleration time can taken by maximum radial acceleration $\frac{V^2}{K \times R}$ — ②.

from equation 1 and 2 $\frac{L}{V} = \frac{V^3}{KR}$

$$L = \frac{V^3}{KR}$$

calculate the length of transition curve when the rate of radial acceleration is 30 cm / sec^3 able speed is 60 km / hr from and the radius of circular curve is 200 m. then, $v = \frac{60 \times 1000}{60 \times 60}$

→ 16.66.

$k = 30$ cm / per sec^3 = 0.3 m / sec^3.

$r = 200$ m

$$v = \frac{60 \times 1000}{60 \times 60} = 16.6 \text{ m/s}$$

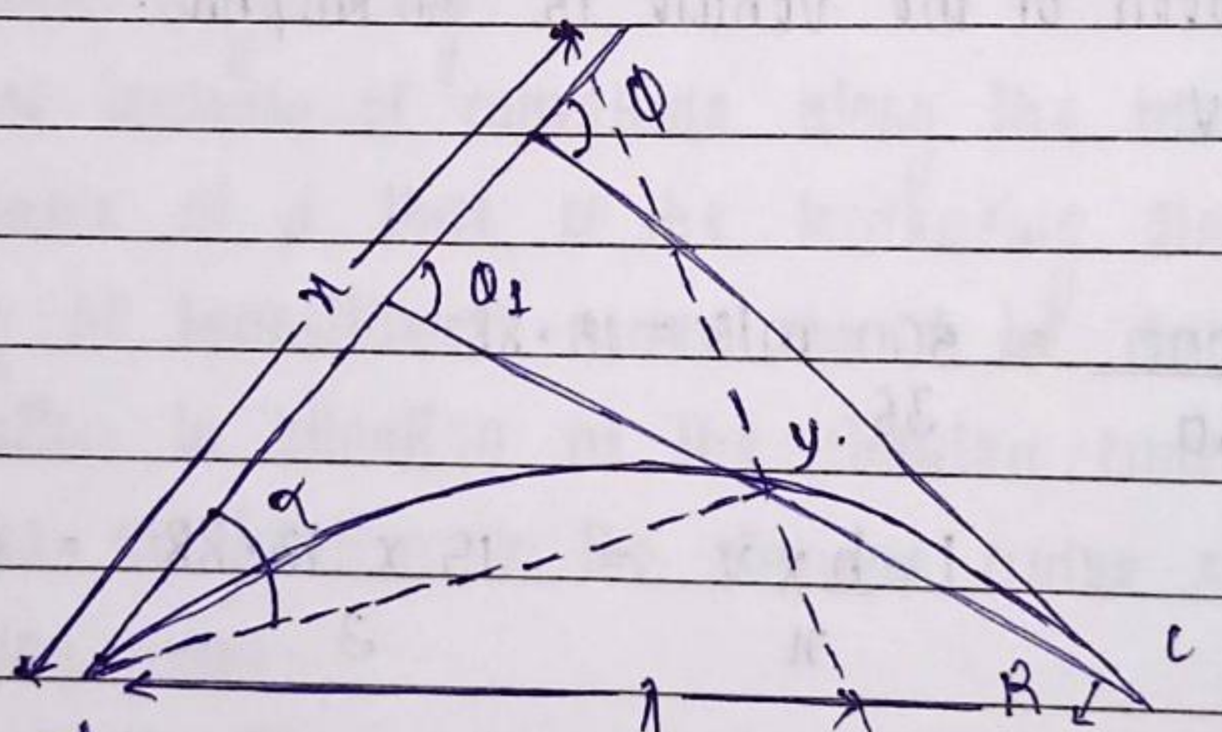
$$L = \frac{(16.66)^3}{0.30 \times 200} = 77 \text{m}.$$

for the intrinsic equation of ideal transitional curve known that

$\alpha = \frac{l^2}{2RL}$ when $\alpha = \alpha_1$ and $l = L$

$\phi = \frac{L^2}{2RL}$ this angle ϕ is known as spiral curve.

Deflection curve →



Deflection of angle ÷

P = any point of transition curve.

C = point of junction between transition curve and circular curve.

ϕ = spiral curve.

α = deflection of angle.

ϕ_1 = Initial tangent angle between the tangent of P.

x = abscissa of point P.

y = ordinate of point P.

R = Radius of circular curve.

l = Length of transitional curve between T and p.

Now $\tan \alpha = \frac{y}{x}$

deflection of angle $= \frac{573 l^2}{RL}$ min

Shift $= \frac{l^2}{24R}$

Elements of combined curve $= (R+s) \times \tan \frac{\Delta}{2} + \frac{l}{2} \left(\frac{1-s}{5R} \right)$

PHOTOGRAPHIC MEASUREMENT :-

* camara axis → It is axis passing through centre of camera lens 1 en both to camera plate and picture plane.

* picture plane → It is the plane perpendicular to camera axis at the focal distance infront of film.

* focal plane → It is the distance from film to photography, approximately the centre of lens when focused at uniformly, focal length as perpendicular to axis of lens.

* principal plane → contain to principal line and optical axis, perpendicular to picture plane and camera plane.

* Expose station → position of air draft at point of each camera explosor is known as expose station.

* Nadir point (N) → It is the point on which an arial photograph where plumb bob are dropped from the front and all point crises the photograph, It is point vertically beneath the explosure station.

* Horizon point (H) → It is the intersection of the principal line with the horizontal line through the prespective station.

* Flyong Height → Elevation of the exposer station above the datum is known as Flyong Height.

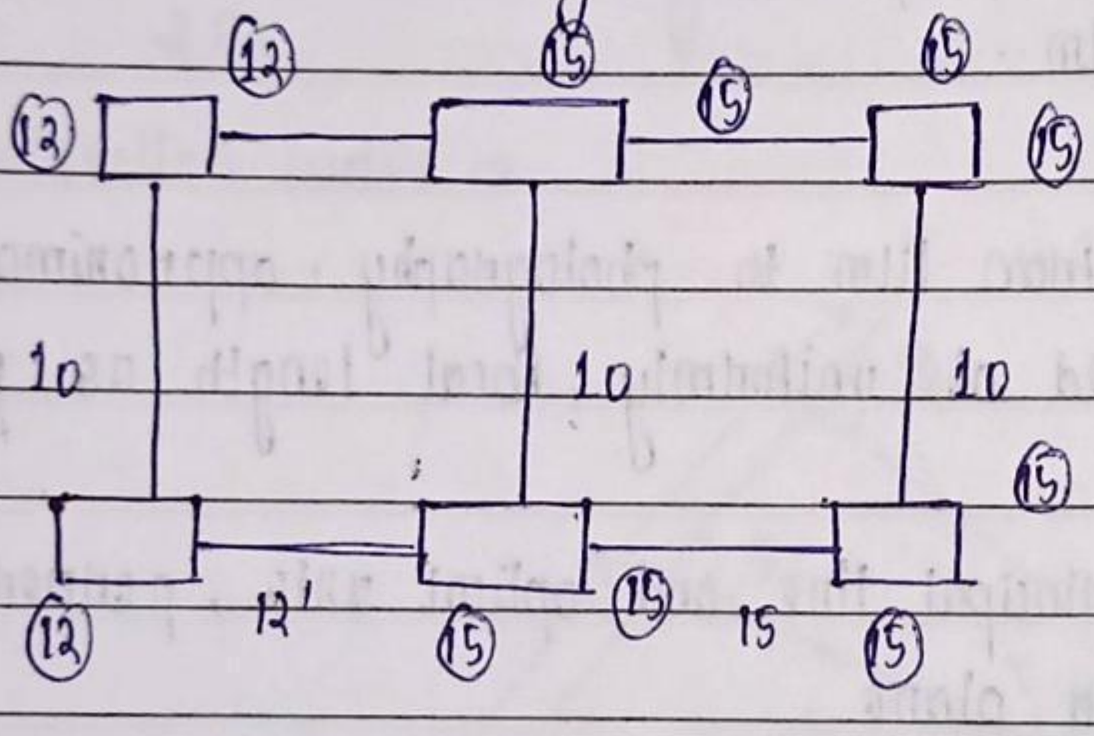
* Tolt → It is the vertical angle obtained by intersection of optical axis with the plumb bob line at the exposer station.

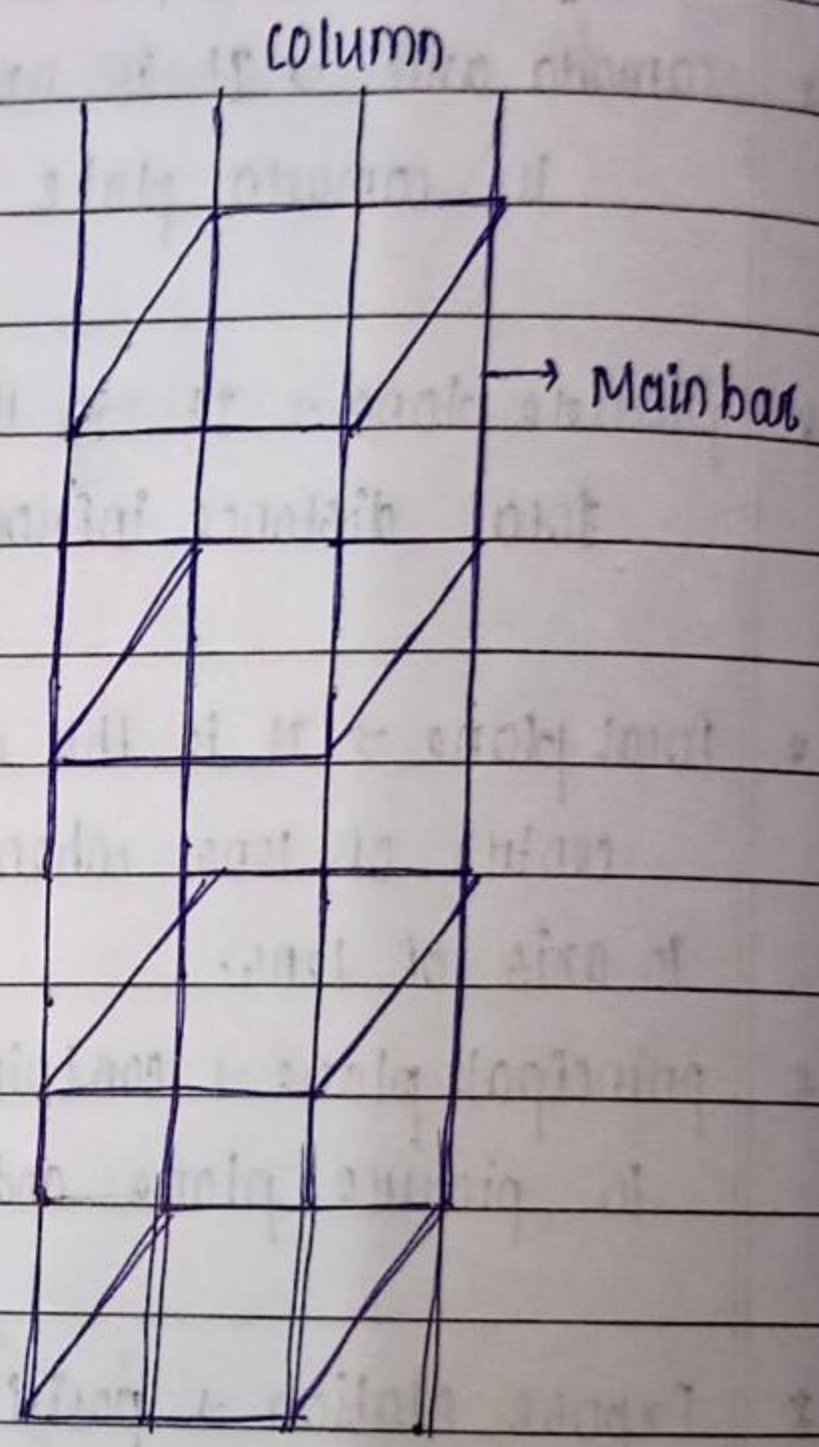
* Top on swing → Rotation of orioal camera about horizontal axis normal to the line and sight as known as top on swing.

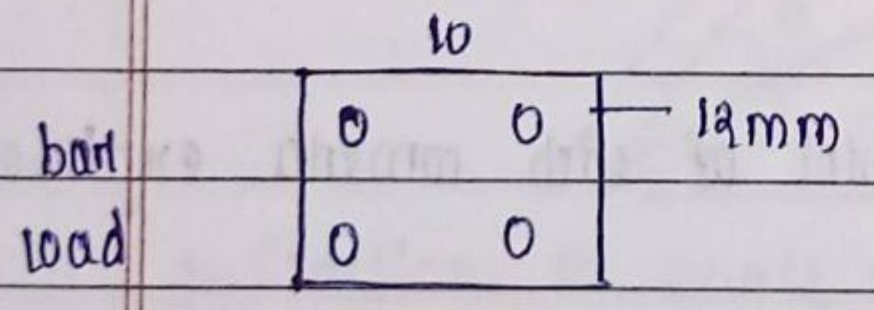
* Scale of photograph → scale = photoscale
clown scale

→ Photos distance / ground distance = f / (H-h)

BBS → Bar bending schedule.







Tension is more where roof concrete.

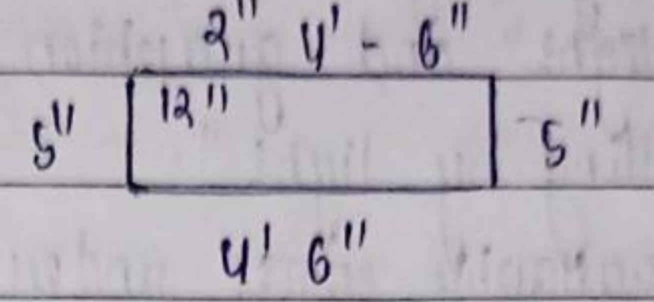
load dia = 12
4 load = 12 × 4 = 48 mm
48 mm × 1.5 + 5% excess
→ 72 + 36 = 75.6 kN
0.83 × 0.83 = 0.6 foot
10 = 60 − 4.8 = 55.2
10 ÷ 12 = 0.83

Steel safety factor = 1.5

48 + 48 = 96 - 75.6 = 20.4

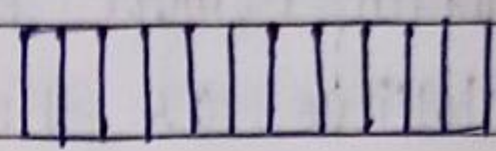
16 Nos EWS = 128'

16 x 24.5 = 391 kg



3.91 x 7600

= 29716



45 + 4.5 + 0.41 + 0.16 + 0.16 = 10' 2'

⇒ 10.16 x 48 Nos

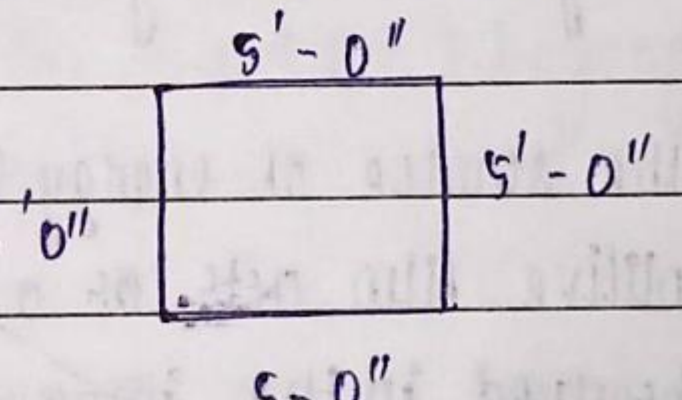
488'

⇒ $\frac{488}{328}$ = 148.78

⇒ 149 m x 0.61 = 1.90.86

= 40 kg

90.9 x 76 = @ 6908 /- x 16 Nos = 110534.



4' - 6" + 5" + 5"

⇒ 4.5 + 0.41 + 0.41

⇒ 5.32 = 5' - 4" 12 Nos

12 Nos x 2 = 24 Nos

1m = 3' 28

$\frac{4.5}{0.41}$ = 10.97 = 11 + 1 = 12

n + 1

1m of steel = $\frac{d^2}{162}$

1m of 8m = 0.39

10m = 0.61

12m = 0.88

16m = 128

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MODULE-5

AERIAL PHOTOGRAPHY ÷ photographing form air is basically known as aerial photography. The word 'aerial' derived in early 17th century from latin word aerius, and greek word aerios. The term "photography" is derived from two greek words phos meaning "light" and graphien meaning "writing" means writing means "writing by light".

Aerial photography comes under the branch of Remote sensing. platforms from which remote sensing observations are made are aircraft and satellites as they are the most widespead and common platforms. Aerial photography is a part of remote sensing and has wide spread and common applications in topographical mapping, engineering environmental science studies and exploration for oil and minerals etc. In the early stages of development, aerial photographs were obtained from balloons and kites but after the invention of air crafts in 1903 aircrafts are being used widely for aerial photographs.

The sun provides the source of energy (electromagnetic radiation or EMR) and the photosentitive film acts as a sensor to record the images. Diversifications observed in the images of photographs shows the different amount of energy being reflected from the objects as recorded on the film. Now adays aerial photography also become digital where values of reflected electromagnetic radiation is recorded in digital numbers

An aerial photographs is any photograph taken from an airborne vehicle (aircraft, drones, balloons, satellites, and so forth). The aerial photograph has many uses in military operations.

However, for the purpose of this manual, it will be considered primarily as a map supplement or map substitute.

Characteristics of Aerial photographs ÷

1. synoptic view : Recording or taking aerial photographs spatically over large area is like birds eye view from the top. These technologies allows discriminating and detecting small scale features

and spatial relationships among them.

2. Time freezing ability : They are defined as virtually permanent records of the existing conditions on earth's surface at one point of time and further can be used as past document.

3. capability to stop action : They provides a stop action view of dynamic state and are used in studying the variable / dynamic phenomena such as flooding, moving wildlife, traffic, oil spills, forest fires, changing dynamics in natural phenomena etc.

4. Three dimensional perspective : Aerial photographs provide a stereoscopic view on the Earth's surface where one can make horizontal and vertical measurements.

5. spectral and spatial resolution : Aerial films are susceptible to electromagnetic rays in wave length (0.3 μm to 0.9 μm) beyond spectral sensitivity of the human eye (0.4 μm to 0.7 μm).

6. Availability : Air borne photographs can be taken on user specific time and make permanent record at a range of scales of any area.

Aerial films : Aerial films is multilayer emulsion laid on a stable anti-halation base. Generally aerial films are available in rolls on that cross section of about 10 inch in wide and 200 to 500 ft in length.

Types of films : Depending upon the suitability for different purpose and unique situations variety of films are available that are used. panchromatic and natural color films are the two most commonly utilized films. These two films along with infrared and false colour form the basic media used in aerial photography.

Scale: scale is define as the ratio of distances between two images on an aerial photograph and the actual distance between the same two points / objects on the ground, in other words the ratio f/H (where f is the focal length of the camera lens and H is the flying height other factors that further affect the scale variations are tilt and relief displacements. Aerial photograph, the image should be of the tilt and highest quality. To guarantee good image quality, recent distortion free cameras are used. some latest versions of camera as have image motion compensation devices to elliminate or reduce the effects of forward motion. Depending upon the requirements, different lens / focal length / film / filter combinations be taken in use.

The types of aerial photograph ÷

aerial photographs are classified into the following types:

i) vertical photographs.

ii) low oblique photographs.

iii) High oblique photographs.

Classification of Aerial photographs :- There are different criteria to classify aerial photographs. Different criteria are scale, tilt angle, angular coverage, type of film and spectral bands. Depending upon these criteria aerial photographs can be classified as follows:

A. Scale:

✓ large scale : between 1:5,000 and 1:20,000

✓ Medium scale : between 1:20,000 and 1:50,000

✓ small scale : between smaller than 1:50,000.

FOCAL LENGTH ÷ focal plane is the flat surface film is held. focal length is the distance from the focal length to approximately the centre of the camera lens. This lens equation is $\frac{1}{f} = \frac{1}{o} + \frac{1}{i}$

F = focal length of the camera

O = distance between object and camera and

i = distance between lens and image plane.
Most metric aerial cameras have a fixed focal length such as 152 mm and 305 mm. Military photoreconnaissance operations commonly employ lenses 3 to 6 feet to obtain detailed photograph from extremely high altitudes.

B. Camera orientation :-
vertical : A vertical photograph is taken with the camera as straight down as possible. Allowable tolerance is usually ±3° from the perpendicular (plumb) line to the camera axis. The result is coincident with the camera axis. A vertical photograph has the following.
characteristics :-
1) The lens axis is perpendicular to the surface of the earth.
2) It covers a relatively small area.
3) The shape of the ground area covered on a single vertical photo closely approximates on square or rectangle.
4) Being a view from above, it gives an unfamiliar view of the ground.
5) Distance and directions may approach the accuracy of maps if taken over flat terrain.
6) Relief is not readily apparent.

OBLIQUE :
a) Low oblique :- This a photograph taken with the camera inclined about 30° from the vertical. It is used to study an area before an attack to substitute for a reconnaissance, to substitute for a map, or to supplement a map. A low oblique has the following characteristic :
1) It covers a relatively small area.
2) The ground area covered is a trapezoid, although the photo is square or rectangular.
3) The objects have a more familiar view comparable to viewing from the top of a high hill or tall building.
4) No scale is applicable to the entire photograph and distance cannot be measured. parallel lines on the ground are not parallel lines on the ground are not parallel on this photo therefore direction cannot be measure.

5) Relief is discernible but distorted.
6) It does not show the horizon.

2) b) High oblique: There high oblique is a photograph taken with the camera inclined about 60° from the vertical. It has a limited military application. It is used primarily in the making of aeronautical charts. However, it may be the only photography available. A high oblique has the following characteristics.

3) 1) It covers a very large area (not all usable).
2) The ground area covered is a trapezoid, but the photograph is square or rectangular.
3) The views varies from the very familiar to unfamiliar, depending on the height at which the photograph is taken.
4) Distances and directions are not measured on this photograph for the same reasons that they are not measured on the low oblique.
5) Relief may be quite discernible but resorted as in any oblique view. The relief is not apparent in a high altitute, high oblique.
6) The horizon is always visible.

Photogrammetry :- The term "photogrammetry" is derived from the three Greek words phot which means light, gramma which means something drawn, and metrion, the noun of measurement. photogrammetry can be defined as the science and art of determining qualitative and quantitative characteristics of objects. Here information is obtained through processes of recording patterns of electromagnetic radiant energy predominantly in the form of photographic images. Objects are identified and qualitatively described by observing photographic image characteristics such as shape, pattern, tone and texture. photogrammetry also allows for the extraction of three-dimensional features from remotely sensed data.

Classification of photogrammetry :-

There are two types of photogrammetry as follows :-

i) Interpretative photogrammetry.

ii) Metric photogrammetry.

Aerial photogrammetry :-

→ photographs taken from a Aerial camera mounted on a aerial vehicle.

→ Used for various purpose, mainly information extraction on the ground surface.

→ Aerial photographs are obtained from the aerial cameras mounted on aerial vehicle (aeroplane for the purpose of photography).

→ used for various purpose, mainly information extraction on the ground surface.

photographs are taken from camera station in the air with the axis of camera vertical (aeroplane).

→ is the branch of photogrammetry where the photographs are taken from air station.

→ This is the best mapping procedure yet developed from large objects and are useful for milary intelligance.

→ For this, aerial camera is used which are fixed on flying aircraft.

Terrestrial photogrammetry :-

The photogrammetric method is the application of terrestrial photogrammetry to trench logging and may be required for very large, irregular fault exposures that cannot be accessed every where. The method was developed in the late 1980 s by fairler et al (1984) and coe et al (1991) using analytical steroplotter.

The advantages of photogrammetry surveying :-

Benifits using photogrammetry for mapping and surveying.

a) Accurate and measured records.

b) No requirement for field work.

c) corresponds better with data sources.

d) Ideal for difficult to access locations.

e) No disturbance to traffic.

f) Easy to describe information.

Scanned by TapScanner

The components of photogrammetry ÷ The 4 key components of photogrammetry capture:

i) location
ii) stillness
iii) camera settings
iv) camera movement

photogrammetry process ÷

step 1: Take images. Take a series of overlapping photos of the chosen object.

step 2: Upload. open your photogrammetry software of choice and import the photos directly into the project library.

step 3: creating the 3d model from images in photogrammetry software.

step 4: post processin.

Acquisition of Aerial photographs and / or Imagery ÷ From time to time there is considerable interest in the purchase of special purpose photography contracted through commercial survey films. Even though commercial films may have the technical expertise to handle almost any type of photographic mission, the client still may be responsible for:

1) defining objectives.
2) drawing up preliminary specifications or light plans.
3) estimating costs.
4) determining whether the finished products meet interpretation and mapping requirements.

This study demonstates that the cropcam UAV together with the digital camera was capable of acquiring the aerial photograph successfully for large mapping. The photogrammetric outputs such as DTM and orthophoto were successful and generated too. These results have been analyzed using the Root mean square error (RMSE) with the new technology. unmanned aerial vehicle could solve problems in many applications especially in small area. It has been proven that UAV platform was very suitable for the project that has limited time and manpower. This technology could be used by any agency or ministry related with environmental studies. For the future, it is also hope that this study could be expanded at large and different flying height to determine the accuracy and cost involve for data acquisition.

control survey ÷ control survey means a survey that provides horizontal or vertical position data for the support or control of subordinate surveys or for mapping. or control surveys establish precise horizontal and vertical relationships of a network of monuments / markers which serve as the coordinates basis for subordinates surveys.

The importance of a control survey :- control surveys provide the standard for accuracy by establishing horizontal and vertical positions of points, subsequently used for job site planning.

The types of control survey ÷ Horizontal and vertical cotrol.

i) Horizontal and vertical control are developed to create a frame work around which other surveys can be adjusted.
Horizontal control surveys coordinate horizontal positional data.
A vertical control surveys determines elevation with respect to sea level.

Start a control survey ÷ i) Identify and mark a number of key fixed points that will serve as control (reference) for all subsequent surveying.
ii) Establish the baseline an accurately measured distance between 2 control points.
iii) station the tripod over a control point.
iv) Mount the transit (theodolite) on the tripod.
v) Release the upper set screw.

Geometric distortion in imaginary ÷ Geometric disortion is an error on an image, between the actual image coordination and the ideal image coordinates which would be projected theoretically with an ideal sensor and under ideal conditions.

causes geometric disortion ÷ All images are susceptible to geometric disortions caused by variations in platforms stability including changes in their speed, altitude, and attitude (angular orientation with respect to the ground) during data acquisition.

The major sources of geometric disortion in aerial images ÷
There are six primary sources of aerial image disortion: terrain, camera tilts, film deformation, camera lens, atmospheric bending, and other camera errors. The terrain, and camera tilts sources of air are considered to be the major sources that contributes the most amount of error.

Geometric correction in image processing ÷ Geometric correction is undertaken to avoid geometric disortions from a disorted image, and is achieved by establishing the relationship between the image coordinate system and the geographic coordinate system using calibration data of the sensor, measured data of position and attitude, ground control points.

The application of imagery and its support data science in civil engineering:
Data science in civil engineering provides a game changing technique for the construction industry that is simulators. This simulator software offers a realistics limitation of the building process of a construction site. It is very crucial in the process to understand the underlying behaviours under different conditions.

The different applications of imagery and its support data in civil engineering ÷ These applications are useful for analyzing and discussing the use of statistics in the practice of civil engineering.

i) Traffic / Transportation engineering.
ii) Surveying and mapping.
iii) Structural Engineering.
iv) Earthquake engineering / seismology.
v) Hydrology.

vii Environmental Engineering.
viii Geotechnical Engineering
viiii Traffic / Transportation Engineering
ix Sanitary engineering.
x Traffic / Transportation Engineering.
xii Coastal and port Engineering.

ORIENTATION ÷

A rotation or set of rotation needed to make the axes of a rectangle cartesian coordinate system parallel to the axes of another similarly, a set of angles made by the axes of one such coordinate system with the axes of another. The act of establishing the correct direction with reference to the points of the compass. A map is in orientation when the map symbols are parallel with their corresponding ground features. A plane table is in orientation when lines connecting positions on the plane table sheet are parallel with the pines connecting the corresponding ground objects. A surveyor's transit is in orientation if the horizontal circle reads 0° when the line of collimation is parallel to the direction it had at an earlier (initial) position of the instrument, or to a standard line of reference. If the line of reference is a median, the circle will show azimuths referred to the meridian. A photograph is in orientation when it correctly presents the perspective view of the ground directly infront of the observer or when the images on the photographs appear in the state direction from the point of observation as do the corresponding map symbols.

ORIENTATION ABSOLUTE ÷ The scaling, levelling and orientation to ground control (in a photogrammetric instrument) of a relatively oriented stereoscopic model or a group of model.

ORIENTATION BAWL ÷ The establishment of the position of both ends of an air base with respect to a ground system of coordinates In all six elements are required. These are essentially the three dimensional coordinates of each end of the base. In practice, however it is also convinient to express these elements in one of two alternative ways ÷

a) as the ground rectangular coordinates of one end of the base and the difference between these and the ground rectangular coordinates of the other hand of the base.

b) as the ground rectangular coordinates of one end of the base the length of the base and the two elements of direction (such as base direction and base tilt).

Orientation exterior → The determination (analitically or in a programmetric instrument) of the position of a camera and its attitude at the instant of exposure over orientation. In sterioscopic instrument practice exterior orientation is divided into two parts, relative and absolute orientation.

Orientation Interior → The interior perspective of a photograph at the instant of exposure inner orientation. The elements of interior orientation are: caliberated focal length, location of the calibrated principal point and calibrated lens disortion.

Orientation relative → The position and attitude of one of the pair of overlapping photographs with respect to the other photograph.

Triangulation → In surveying triangulation is the process of determining the location of a point by measuring only angles to it from known points at either end of a fixed.

What is meant by triangulation in surveying ÷

Triangulation is a surveying method that measures the angles in a triangle formed by three survey control points using trigonometry and the measured length of just on side and the other distance in a triangle are calculated.

Type of survey is triangulation used ÷ points inside the triangles can all then be accurately located with referance to it. such triangulation methods were used for accurate large scale land surveying until the rise of global navigation satellite system in the 1980s.

The four types of triangulation ÷ Among experts in triangulation in the social sciences, there continues to be a general consensus on the usefulness of the four types of triangulation originally identified by denizen in the 1970s.

i) Data triangulation
ii) Investigation triangulation.
iii) Theory triangulation.
iv) Methodological or method.

Triangulation work is carried out in following step ÷

a) Reconnaissance
b) Erection of signals and towers.
c) Measurement of Horizontal Angles.
d) Astronominal observations necessary to determine the true meridian and the absolute positions of the stations.
e) Measurement of Base line.
f) Adjustment of observed angles.

The advantage of triangulation ÷ Triangulation can help: Reduce bias that comes from using a single method, theory or investigator. Enhance validity by approaching the same topic with different tools. Establish creadibity by giving you a complete picture of the research problem.

The disadvantage of triangulation ÷ Since it is used to survey a long narrow strip, a no. of base lines must be introduced frequently to reduce the accumulation of errors. Therefore, a chain of triangles is never permitted in high order triangulation.
least accurate method.

Application of triangulation surveying ÷

a) Establishing accurately located control points for plane and geodetic surveys of large areas.
b) Establishing accurately located control points in connection with aerial survey.
c) Accurate location of engineering projects such as centre lines, terminal points and shafts for long tunnels, and centre lines and abutments for

long span bridges.

Example ÷ Triangulation may be used to find the position of the ship when the positions of A and B are known. An observer at A measures the angle α, while the observer at B measures β.

The position of any vertex of a triangle can be calculated if the position of one side, and two angles are known. The following formulae are strictly correct only for a flat surface if the curvature of the Earth must be allowed for, then spherical trigonometry must be used

Calculation ÷

With l being the distance between A and B we have:

$$l = \frac{d}{\tan \alpha} + \frac{d}{\tan \beta}$$

Using the trigonometric identities $\tan \alpha = \sin \alpha / \cos \alpha$ and $\sin(\alpha+\beta) = \sin \alpha \cos \beta$ this is equivalent to:

$$l = d\left(\frac{\cos \alpha}{\sin \alpha} + \frac{\cos \beta}{\sin \beta}\right)$$

$$l = d\,\frac{\sin(\alpha+\beta)}{\sin \alpha \cdot \sin \beta}$$

therefore:

$$d = l\,\frac{\sin \alpha \cdot \sin \beta}{\sin(\alpha+\beta)}$$

From this, it is easy to determine the distance of the unknown point from either observation point, its north/south and easy/west offsets from the observation point, and finally its full coordinates.

Stereoscopic measurement ÷ for example, the stereoscopic measurement system 100 is used to calculate a current distance between two two user-designated points in the stereo images of the exterior of a buildings.

Stereoscopic viewing ÷ Taken literally, stereoscopic vision describes the ability of the visual brain to register a sense of three dimensional shape and form from visual inputs. In current usage, stereoscopic vision often refers uniquely to the sense of depth derived from the two eyes.

Analyze with a stereoscope ÷ Examination of a mixture under a stereoscope may yield variation of its component particles. These particle may vary in their shape, size, color, capacity, texture or other physical properties which can be observed microscopically. The particle may then be physically separated from the mixture.

Use a stereoscope ÷ place a small solid specimen onto the stage such as a card, coin or any other flat, detailed object. Turn the magnification adjustment knob to the lowest power and bring the image in to focus using the focus control. Adjust the eyepieces for the correct interpupillary distance to suit you.

Advantages of stereoscopic vision ÷ With the help of stereoscopic vision, humans can manage to handle small objects. It helps to reciprocate threats and and react accordingly. provides a deep sense of perception. It helps to achieve accuracy in various profiles like the manufacturing industry.

calculate stereoscopic parallax ÷ p = absolute stereoscopic parallax at the base of the objects. p can be determined by measuring the distance the pp and cpp on each of the stereo air photos and calculate the mean which is the average photo air base (p) between the two exposure stations (i.e, absolute stereoscopic parallax).

x-parallax ÷ Absolute parallax is in the direction, it is the algebraic difference of the distances of the two images from their respective photograph nadirs, measured in horizontal plane and parallel to the air base.

y-parallax ÷ y-parallax is defined as displacement at right angle to the line of flight. since y-parallax is not commonly used aerial photography for forestry purposes there no further explaination of y-parallax is given here.

parallax difference (dp) ÷ The difference in x-parallax two different image points is a measure of the distance of one point above the other. In other words, parallax difference is a difference between the x-parallax at the top and x-parallax at the bottom.

DTM in surveying ÷ Digital Terrain models sometimes called Digital Elevation models (DEM) is a topographic model of the bare Earth that can be manipulated by computer programs. The data files contain the elevation data of the terrain in a digital format which relates to a retangular grid.

DTM generation ÷ Aerial, photography up to now the method of choice for topographic mapping, are well known. Airborne laser scanning has gained almost significance for the generation of digital terrain models (DTM). A prospering technology stimulates a continual development and improvement of methods and algorithms.

Difference between a DEM and a DTM ÷ DTMs are often confused with DEMs. The main difference between the two models lies in the fact that the DEM generally takes into account all persistent objects on the ground (vegetation, buildings and other airfacts) while the DTM shows the development of the geodesic surface.

DEM made ÷ DEMs can be created from ground surveys, digitals existing hard copy topographic maps or by remote sensing techniques. DEMS are now predominantly created using remote sensing techniques with Smith and clark (2005) observing the benifits that a large spatical area can be mapped by fewer People at a lower cost.

8/6/22

DEM photogrammetry ÷ DEM derived from photogrammetric generated DSM using morphological filter. Abstract : Digital elevation model (DEM) is a terrain model consisting of elevation data and representing the bare earth surface.

Ortho image in GIS ÷ An orthophoto, orthophotograph, orthoimage or orthoimagery aerial photograph or satellite imagery geometrically corrected such that the scale is uniform : photo or image follow a given map projection.

DEM data is generated ÷ Digital elevation models (DEMs) can be derived through a variety of techniques, such as digitizing contours differential topographic levelling, EDM (Electronic Distance measurement) differential GPS measuremen (digital) photogrammetry, Radar remote sensing (INSAR) and light detection and ranging.

Type of imagery is necessary to produce an orthomosaic map ÷ There are several requirements to produce an ortho image or orthomosaic from raw imagery : Digital imagery can be in the form of digital airborne image scanned image or satellite imagery.

An orthophoto is obtained in aerial photogrammetry ÷ orthophotographs are produced by scanning arbutes aerial photo diapositive, ortho erectifying the digital image, and registering it to a coordinate system and map projection. convectionally, mapping is done by aerial photogrammetry satellite image and tacheometry using total station.

orthophoto can be used as base map in GIS ÷ orthophotographs have the positive attributes of a photograph such as detail and timely coverage, and the positive attributes of a map including uniform scale and true geometry. This enhance orthophotographs to be used in their primary role as a backdrop on which map features can be overlaid.