Introduction to surveying -

Definitions: Surveying is the art of determining the relative positions of points on, above or beneath the surface of the earth by means of direct or indirect measurements of distance, direction and elevation.

★ Primary Divisions of survey

1) Geodetic surveying:
   i) Shape of earth is taken into account
   ii) All lines lying on the surface are curved lines & the triangles are spherical triangles
   iii) It includes work of larger magnitude & precise position

2) Plane surveying:
   i) Mean surface of earth is considered as plane & Spheroidal shape is neglected
   ii) All triangles formed by survey lines are considered as plane triangles
   iii) Level line is considered as straight & all plumb lines are considered as parallel

* Classification

A) Classification Based on nature of the field survey

1) Land Surveying

i) Topographical Surveying

→ It consist of determination of relative horizontal & vertical location of certain points by linear & angular measurements

→ Made to determine natural features of country (rivers, streams, lakes, hills etc) & artificial features (Roads, Railways, canals, towns etc)

ii) Cadastral Surveys:

→ Made to Fixing of property lines, calculation of land area, transfer of land property from one owner to another, fix boundaries of Municipalties & of state & federal jurisdictions.

iii) City Surveys:

→ Made in connection with construction of Streets, water supply system, sewers & other works

2) Marine or Hydrographic Survey :-

→ Survey deals with bodies of water for purpose of Navigation, water supply, harbour work, determination of mean sea level,

→ It is made for the determination of discharge of streams, survey on shores & banks, depth of water, fluctuations of water tide.

3) Astronomical survey: & direction
→ Made to determine absolute location of any point/line on the surface of earth
→ consist of observations to heavenly bodies such as the sun or fixed star

B) Classification based on the object of survey

1) Engineering survey:
→ It is undertaken for determining quantities, for designing of engineering works such as roads, reservoirs, sewage disposals, water supply etc

2) Military survey:
→ Used for determining points of strategic importance

3) Mine survey:
→ Used for exploring mineral wealth

4) Geological survey:
→ Used for determining deferent strata in the earth's crust

C) Classification based on instrument used

1) Chain survey
2) Theodolite survey
3) Traverse survey
4) Triangulation survey
5) Tacheometric survey
6) Plane Table survey
7) Photogrammetric survey
8) Aerial survey

* Plans & Maps

i) Plans :
- → Geometric representation of feature on plane paper
- → Area involved is small & scale is large
- → It shows only horizontal distance & direction

ii) Map :
- → Geometric representations of features on plane paper
- → Area involved is large & scale is small
- → horizontal distance, direction & also vertical distances are shown by contour lines

* Scales :

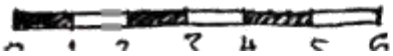
Scale is fixed ratio that every distance on the plane bears with corresponding distance on ground

Representation of scale / Types of scales :

1) Engineer's scale
- → 1cm on plan represents some whole no. of meters in ground ex:- 1cm = 10 m

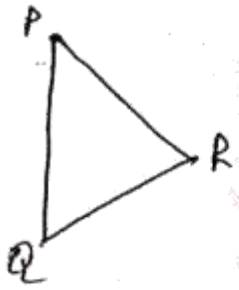
2) Representative fraction :-
- → one unit of length on plan represents some number of same units of length on the ground
- ex: 1/1000 or 1 in 1000

3) Graphical scale :-
- → Line sub-divided into plan distance corresponding to convenient units of length on the ground

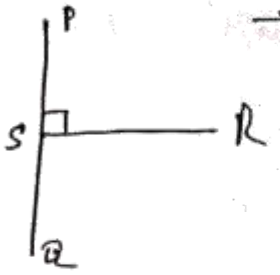
Ex:-  (Here 1cm = 1km)

✱ Principles of Surveying

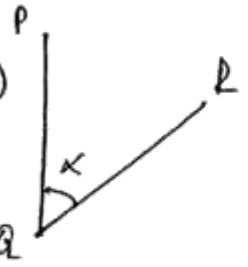
1) Location of a point by measurement from two point of reference

i) 

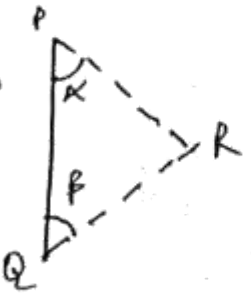
→ Point R can be located/plotted by swinging two arcs from P & Q (used in chain survey)
(Length PR & QR measured on field)

ii) 

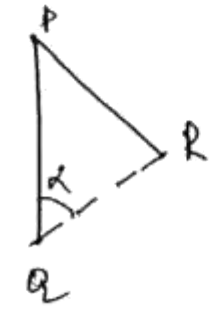
→ Perpendicular RS can be dropped wrt PQ & length PS & SR are measured
→ point R can be plotted using set square
(Used for defining details)

iii) 

→ Angle PQR & dist QR can be measured & R is plotted using protractor/trigonometrically
(Used in traversing)

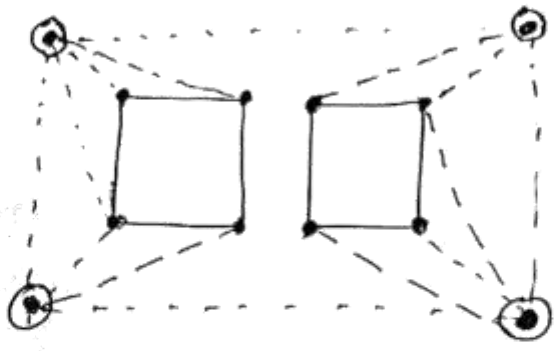
iv) 

→ Only Angle QPR & PQR are measured & R is plotted by extending lines.
(Used in triangulation)

v) 

→ Only distance PR & angle PQR are measured & Point R is plotted by protracting angle & swinging arc from P
(Used in traversing)

2) Working from whole to part
→ Establish first system of control points and to fix them with higher precision
→ Minor control points can be established by less precise methods
→ Main aim is to prevent the accumulation of errors & to control & localise minor errors which otherwise, would expand to greater magnitude,



⊙ Major control points with high precision
• Minor control point wrt major control points with less precision.

★ Precision & Accuracy:

i) Precision: It is degree of perfection used in instruments, the methods & the observations
ii) Accuracy: It is degree of perfection obtained

a) True error: Diff b/w measurement & True value
b) Discrepancy: Diff b/w two measured values of the same quantity

★ Instrument for chaining :

1) Chain / Tape
2) Arrows
3) Pegs
4) Ranging Rods
5) Offset rods
6) Plumb bob

1) Chains : are formed of straight links of galvanised mild steel wire bent into rings at the ends & joined each other by three small circular/oval wire rings.

★ Types of chains

i) Metric chain
→ Measurement are done in terms of meter
→ available in length of 5, 10, 20 & 30 m.
→ consists of 100 links.

ii) Gunter's chain / surveyor's chain
→ It is 66 ft long & consists of 100 links
→ each link being 0.6 ft / 7.92 inches
→ 10 sq chain = 1 acre
→ 10 chain = 1 furlong & 80 chain = 1 Mile

iii) Engineer's chain
→ It is 100 ft length & consists of 100 links

iv) Revenue chain.
→ 33 ft long & consists of 16 links
→ 1 link = 2 1/16 ft
→ Generally used in cadastral survey

v) Steel band / band chain :
→ consist of long narrow strip of blue steel of uniform width of 12 to 16 mm & 0.3-0.6 mm thick
→ Available in length of 20m & 30m
→ Accurate & lighter than chain

2) Tape :
Generally used for more accurate measurements

Types of Tapes :-

i) Cloth / linen Tape :
→ Made with closely woven linen, 12 to 15 mm wide, varnished to resist moisture, are light & flexible
→ Available in 10, 20, 25, & 30 m & 33, 50, & 60 ft

ii) Metallic Tape :
→ Made of varnished strip of waterproof linen interwoven with small brass, copper / bronze wires & does not stretch easily as cloth tape
→ Available in 2, 5, 10, 20, 30 & 50 m.

iii) Steel Tape :
→ Consist of light steel strip of width 6 to 10 mm & is more accurately graduated
→ Available in 1, 2, 10, 20, 30 & 50 m.

iv) Invar tape:
→ Used mainly for very high degree of precision
→ Made of alloy of nickel (36%) & steel
→ very low co-eff of thermal expansion

★ Ranging:

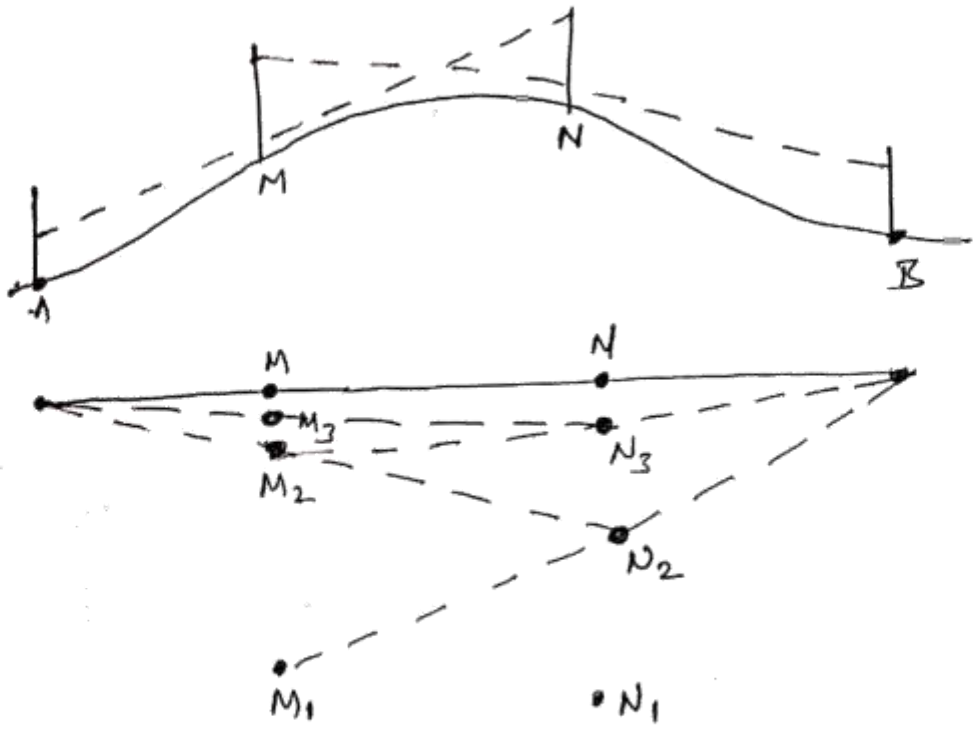
The process of fixing or establishing intermediate point when distance between two points is more than 1 chain / 1 Tape.

* Methods of Ranging

i) Direct Ranging
ii) Indirect Ranging (Reciprocal Ranging)

i) Direct Ranging:
It is done when the two ends of survey lines are intervisible

ii) Indirect Ranging:
It is done when the two ends of survey lines are not inter visible either due to high intervening ground or long distance.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