

Surveying-II

CE-205 (T)

Lecture 6

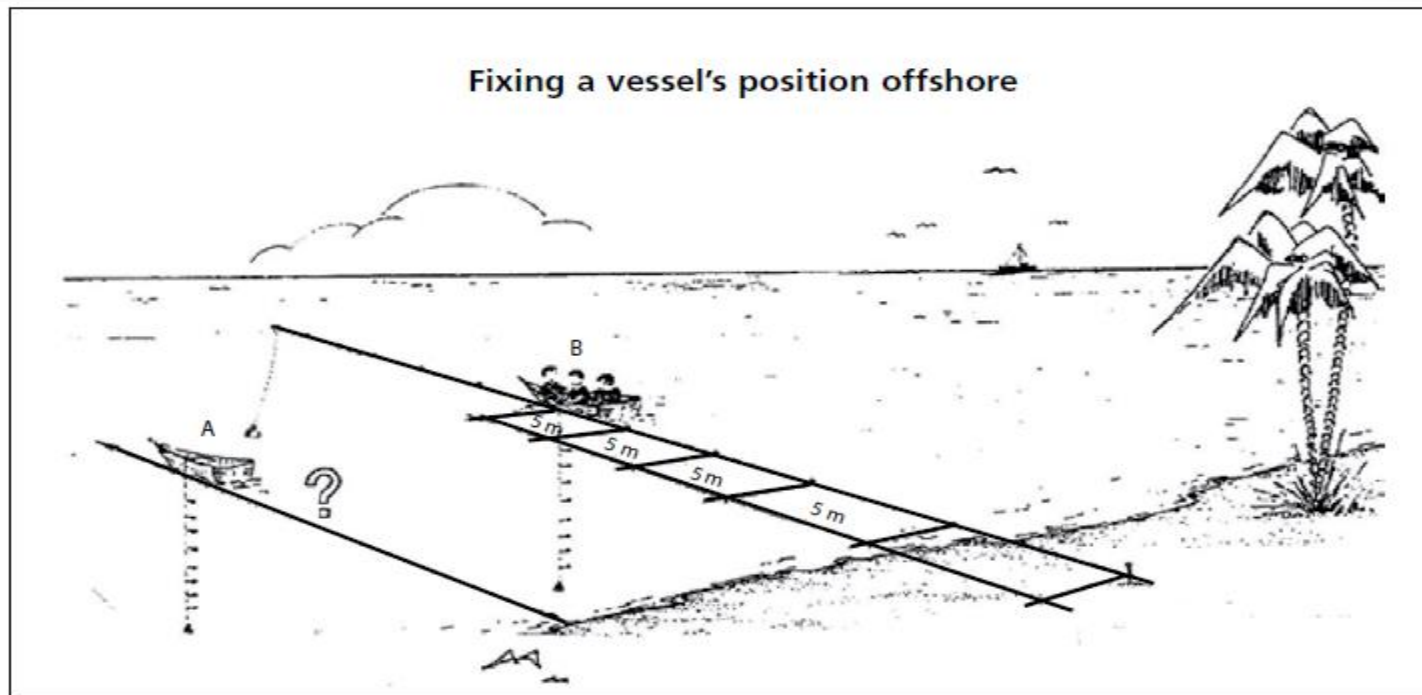
Hydrographic Surveying

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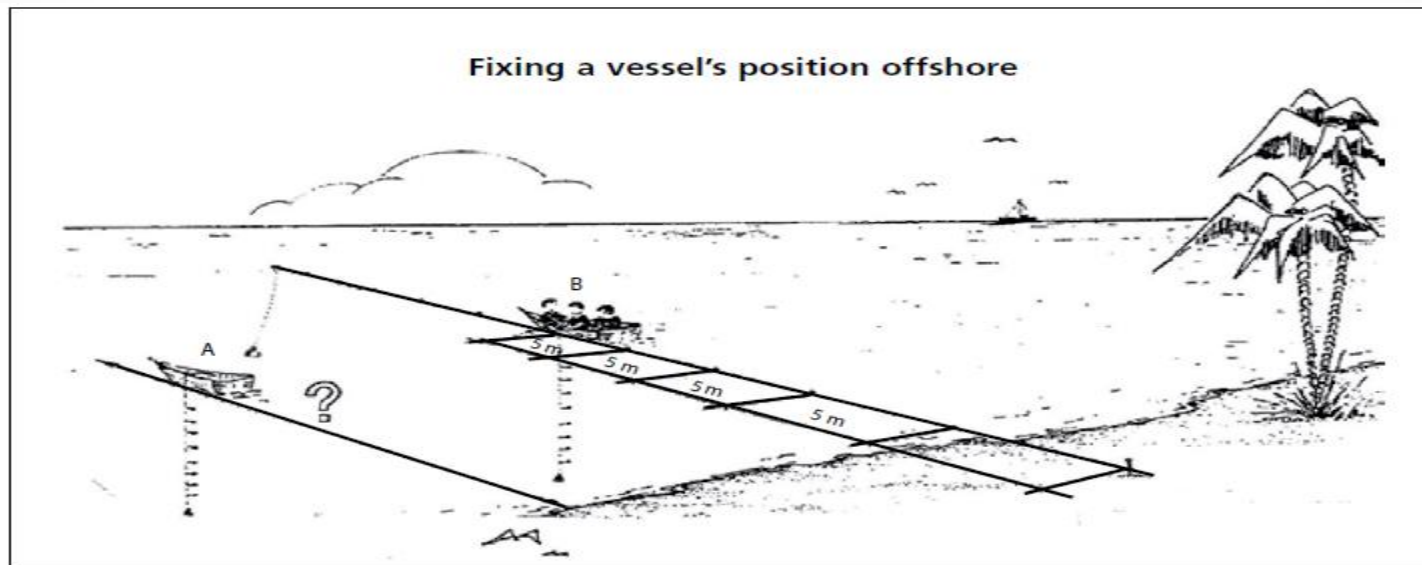
Hydrographic Surveying

- 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 & under water features.
- Hydrographic survey are made to acquire & present data on lake, bay or harbours.



Hydrographic Surveying

- It comprises all survey made for the determination of
 - Shore line
 - Soundings
 - Characteristics of the bottom
 - Areas subjected to scouring and silting
 - Depth available for navigation
 - Velocity & characteristics of flow of water
- The location of buoys ,light house, rocks, sand bars etc



Hydrographic Surveying

Objective of hydrographic survey

- 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 & land drainage scheme.
- 3) Determination of direction of current in connection with
 - Location of sewer out fall
 - Determination of the area subjected to silt & scour
 - For navigation purposes
- 4) Measurement of quantity of water & flow of water in connection with water scheme, power scheme, flood control etc

Hydrographic Surveying

Why we need hydrographic survey

- a) Off shore engineering & the shipping industry have continue to expand.
- b) Drilling rigs, located up to 125 miles (200 km) offshore search for resource particularly oil & gas.
- c) Off shore island are constructed of degraded material to support marine structures.
- d) Harbours depths up to 80 feet (25 m) are required to accumulate the larger ships & tankers.
- e) Containerization has become an efficient & preferred method of cargo handling.
- f) The demand for recreational transportation ranges from large cruises through ship to small sail boats.

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Hydrographic Surveying

Control on hydrographic survey

- The first step in making the hydrographic survey is to establish the control, i.e both horizontal & vertical Horizontal Control.
- In an extensive survey the primary horizontal control is established by triangulation & the secondary one by running the transit (theodolite) & tape transverse between the triangulation station , the transverse lines been run to follow the shore line approximately.
- In survey of less extent the primary horizontal control only is required & is established by running a transit & tape transverse line , sufficiently close to the shore line.
- For rough work the control may be established by running a transit & stadia transverse or plane table transverse.

Vertical Control

- It is based upon a series of bench mark established near the shore line by spirit leveling or direct leveling & these serve for setting & checking tides gauges (to find level of water) to which the sounding are preferred.

Hydrographic Surveying

SHORE LINE SURVEY

Purpose

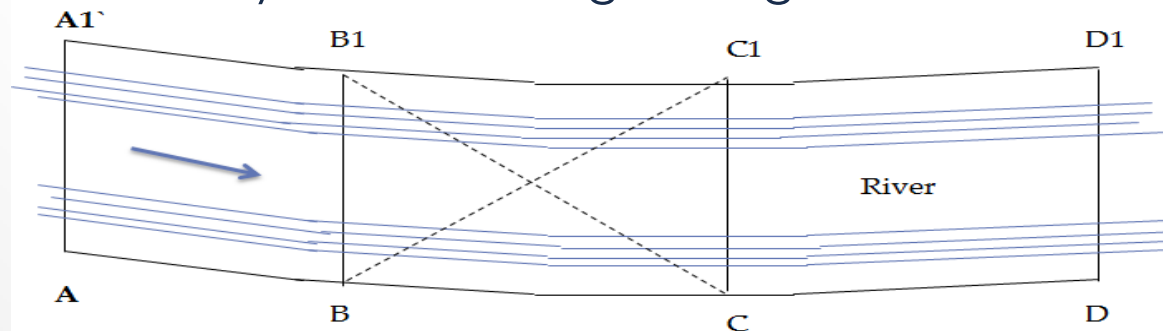
- a) To determine the shore line
- b) To locate the shore detail , prominent topographical features, point of reference etc
- c) To determine the high & low water lines for average springs tides both in planes & in elevation in the care of tidal water.

- All the irregularity in the shore line as well as the shore detail are located by means of offset measured with a tape from the transverse line by the stadia or plane table.
- The point of reference should be clearly visible from the water & should be near enough such as flag poles etc.
- Buoys anchored off the shore & lighthouse are used as reference points.
- The position of the high water line may be judge roughly from deposits & marks or rock.
- However to locate it accurately, the elevation of mean high water is determine & the points are located on the shore in the elevation, the line connecting these points represents the high water line.

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River Survey

- The survey of a shore line of a river is usually made by running a transit & tape transverse on the shore at a convenient distance from the edge of the water.
- The point where there is appreciable change in the direction of shore line are then located by tape offsets from transverse lines, by stadia or plane table method.
- If a river is narrow a single transit a tape transverse is run on one bank & the both banks located by tacheometer or plane table method.
- If the river is wide it is necessary, to run transverse on both banks & locate each shore line by tacheometry or plane tabling from its transverse.
- For checking purpose the two transverse should be tied to each other at interval by cross bearing or angle as shown in fig

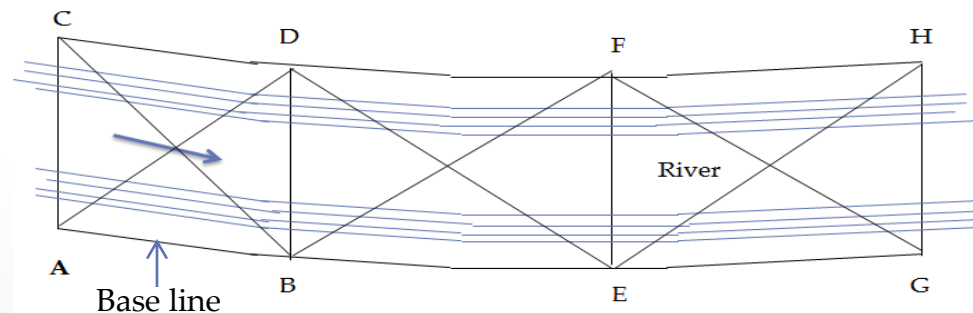


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River Survey

From there angle & measured length of BC. B_1C_1 may be computed .
If it is in close agreement with the measured length of B_1C_1 . The fig BCC_1B_1 is checked completely.

- If the river is too much crooked (irregular) it is not necessary to follow it closely but the transverse may be run in the most favorable location & subsidiary transverse run around bends to locate the necessary details.
- Where the shore line of the rivers are obstructed by wood. It is not economical to locate them by traversing ,it is required to use system of triangulation as shown in fig .
- As a check upon a survey a base line is measured at the end of the survey & also additional check basic are measured at interval of 10 or 15 miles.



Hydrographic Surveying

Sounding

- The measurement of depth below the water surface is called sounding.
- The object of making soundings is to determine the configuration of the bottom of the body of water.
- This is done by measuring from the boat the depth of water at various points.

Sounding are required for

- The preparation of charts for navigation.
- Determination of quantity of material dredged & the area where the material is to be dredged or where the dredged material may dumped.
- The design of work i.e. break water, sea wall etc

Hydrographic Surveying

Gauges

The gauges may be divided into two classes

- Non self registering
- Self registering

In observer is required to read non self registering while the self registering is automatic & is generally used when it accurate & continuous record of fluctuation of the water surface is required.

Types of non self registering gauges

1) Staff gauge

2) Float gauge

3) Chain or weight gauge

- The gauge should be established at a convenient place where is unaffected by the action of waves & protected from storms.
- The type of gauge which is in common use is the staff gauge.
- Mean sea level at a certain place is adopted as a datum for leveling.

Hydrographic Surveying

Equipments for making sounding

A) Sounding boat

- It should be sufficiently roomy & stable . A flat bottom boat is suitable in quiet water while round bottom boat is convenient in rough water.
- A power boat (steam or motor launch) is most suitable when wind is blowing & water currents are strong.

B) Sounding Rods (Or Poles)

- Sounding rods are convenient in shallow & smooth water up to depth of about 4 to 6m (15 to 20 feet) .
- They are made of well seasoned tough timber & are circular in cross section of 5cm diameter (2inch) & usually 3 to 7.5m long (12 to 25ft long) , graduated in meter or feet with a metal shoe at the bottom.
- Direct depth measurements are taken by lowering it vertically into the water until it hits the bottom & reading the graduation at the surface.

Hydrographic Surveying



Sounding/Range Pole

Hydrographic Surveying

Equipment for making sounding

C) Lead Line

- Lead lines are also called sounding lines are used for depth over about 6m (20ft). It consists of suitable length of stretch-resistance cord or other material to which a heavy lead weight 5 to 10 lb is attached.
- The cord is marked with feet or meter graduation & there should be checked frequently against a steel tape, for their accuracy.
- In use the weight is lowered into the water being careful to keep the cord vertical. The graduation at the surface is read when the weight hits bottom.

D) Sounding chain

- For regular sounding a brass chain is most satisfactory since its length is practically constant.
- The links are welded . the brass tags are attached at 0.2m interval but leather or cloth tags are preferred as the brass tags can injure the hands of the lead man .
- The chain should be tested periodically.

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Use of Sounding Pole

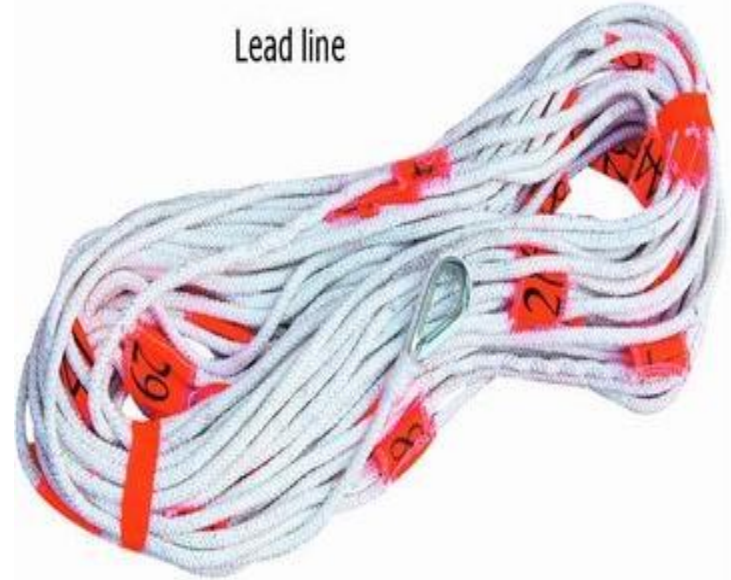


Lead Line

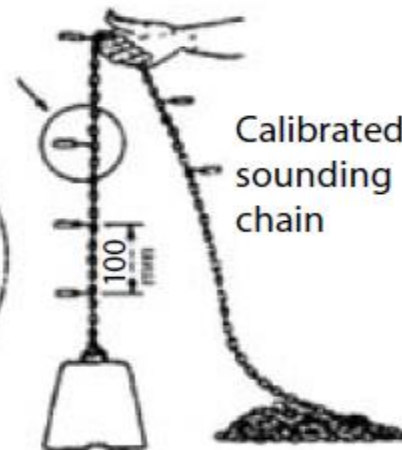
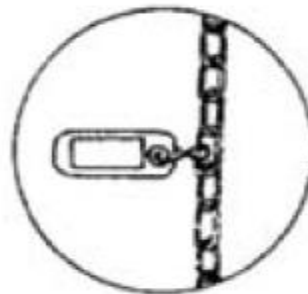


NOAA

Lead line



Detail A



Calibrated sounding chain

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Equipment for making sounding

E) Sounding Lead

- The weight attached to the lead line conical in shape & varies from 2.5 kg to 12.5 kg depending upon the depth of water & the strength of the water currents.
- The shallow still water weight equal to 2.5 kg (5 lb)
- Moderate depth upto 10m (40 ft) weight is equal to 5kg (10lb)
- Greater the depth where current are strong weight is equal to 10kg (20lb)
- The weight is circular in cross section & length equal to 3 to 4 diameter & slightly tapers towards the top end.

F) Sounding Machine

- It is very useful when much sounding is to be done.
- The type commonly used in hand driven & consists of a paino wire carrying a 7 kg load & wound around a drum .
- Two dials , the outer one indicated the depth in m or ft & an inner one is tenth of a meter

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Sounding Machine

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Equipment for making sounding

7) Fathometer:

- For ocean sounding an instrument known as fathometer is used.
- It is electric device and measure the time required for the sound (impulses) travel to the bottom of water and back.
- The travel time is converted into depth displayed in either digital or graphic for fathometer is also called echo sounder.

8) Sextant:

- The theodolite and other instrument used in land surveys are not used in a boat where the support is unstable. The sextant is well suited to hydro graphic work and has the added advantage of measuring angles in any plane.
- It is the most precise hand instrument yet device for measuring angles.
- There are two versions of the instruments
 - a) Nautical sextant (or sounding sextant)
 - b) Box sextant.

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Equipment for making sounding

9) Signals:

- Shore signals are required to mark the ranges i.e, lines along which sounding are to taken and the reference points to which angular observations are to be taken from the boat.
- They should be clearly visible for considerable distances. If the water is shallow, ordinary pole signal may be used but if water deep buoys are used as signals.

10) Ranges:

- The lines on which sounding are taken are called ranges or range lines.
- They are laid on the shore parallel to each other and at right angles to the shore line or radiating form a prom nay natural object when the shore line is very irregular.
- Each range line should be marked by means of signals erected at 2 points it, at considerable distance apart.
- The spacing of range lines vary form 6m 30m (20 to 100ft) depending upon the object of survey and the nature of the bottom.

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Hydrographic Surveying

Sounding Party:

- The personnel of the sounding party depends upon the method used in locating soundings.
- When the sounding are located from the boat, the sounding party consist of:

1) The surveyor or chief of the party: He directs and supervises all operations, sees that boat is kept on the range and usually acts as signalman. Sometimes he acts as the instrument man.

2) The instrument man who takes angular observation on the shore objects

3) The recorder who makes the soundings as they are called out the leadsman,

4) The leadsman who makes the soundings and calls on the readings in feet and tenths to the recorder

5)The boat crew comprising two to three experience oarsmen to steer the boat and keep it in the range

6) The signal man who makes the signal. When the signal is to be given , he holds up the flag for about 10 sec and drops it suddenly at the instant, the sounding is made.

Hydrographic Surveying

Ranges

- The lines on which soundings are taken, are called ranges or range lines.
- They are laid on the shore parallel to each other and at right angles to the shore line or radiating from a prominent natural object.
- Each range line should be marked by means of signals erected at two points on it which should be a considerable distance apart.
- The position of the signal defining range should be carefully located by direct measurement, stadia or triangulation.
- In case of river or stream of great magnitude the ranges are usually run at right angles at axis of the stream, the signal being erected on either one bank or both banks.
- The spacing of the range lines ranges from 6m to 30m, depending upon the object of the survey and the nature of the bottom.

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Making the Soundings:

- Up to depths of 20m (75feet), the sounding are made while the boat is in motion.
- If the sounding is made by the sound rods, the leadsman stands in the bow and plunges it in forward direction far enough that when it reaches the bottom, it will in vertical position.
- He then reads the quickly and calls out the observed reading of each sounding to the recorder who repeat it and records it as well as the time and number of of the sounding.
- The nature of bottom is observed and recorded at intervals in the note book.
- When the sounding line is used, the leading plunges the lead forward at such a that the line will become vertical at point where the sounding is to be taken when leads reaches the bottom.
- If the water is very deep and still, sounding, are taken by stopping the boat for each sounding.
- For ordinary engineering purposes sounding are taken at 8-15m intervals but for special purposes they may be taken at as close as 2 to 3m intervals.

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Methods of Locating Soundings:

Soundings may be located by the following methods which are commonly used

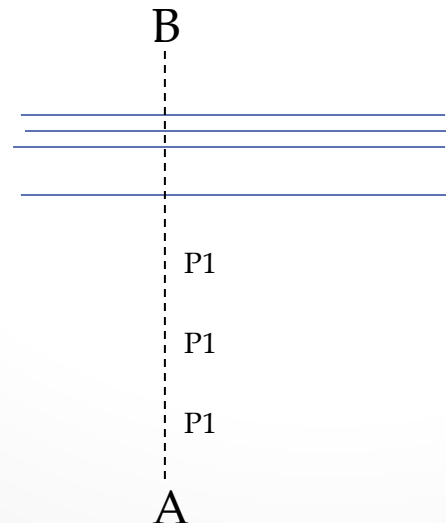
- 1) By transit and stadia
- 2) By range and time intervals
- 3) By range and one angle from shore
- 4) By range and one angle from boat
- 5) By two angles from shore
- 6) By two angles from boat
- 7) By intersecting ranges
- 8) By cross rope
- 9) By distances along a wire or rope stretched across a stream between stations.

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Methods of Locating Soundings:

A) By transit and stadia

- In this method a transit is set up at point on the range and the stadia readings are taken on a stadia rod held on the bottom of the boat at the instant the sounding is taken.
- The transit can be set up at any shore line whose position has been previously fixed.
- In shallow water the stadia rod may be dispensed with and the stadia readings are taken on the sounding rod.
- It is unsuitable when the soundings are taken far from shore.



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Methods of Locating Soundings:

B) By range and time interval

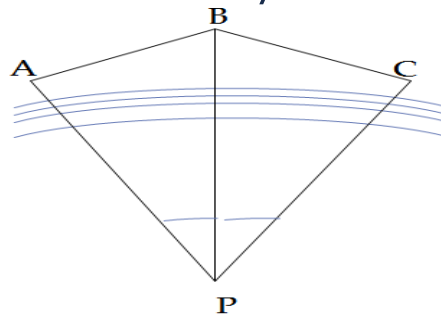
- In this method the sounding boat is rowed at uniform speed along the range and the soundings are taken at regular intervals of time
- The method is particularly applicable in still water and or short distances and when great accuracy is not required.
- Best used in conjunction with other methods.
- In such case the first and last soundings on a line of soundings are located by angular observation from shore .
- The intermediate soundings are then located by interpolation according to time intervals.

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Methods of Locating Soundings:

C) Location by two Angle from boat

- In this method the positions of sounding are located by measuring two angles simultaneously with a sextant, from the boat (P) to three shore signals or any points (A, B, and C) whose positions have been previously known.
- The points sighted should be well defined such as chimneys, light houses etc.
- In this work it is important that the angles must be measured simultaneously and therefore observation are taken both by the surveyor and the instrument man(angle APB and angle BPC)
- In order to minimize the error in measuring the angles and plotting them, the nearer object should be proffered to distant one. This method is commonly used where no ranges are employed.

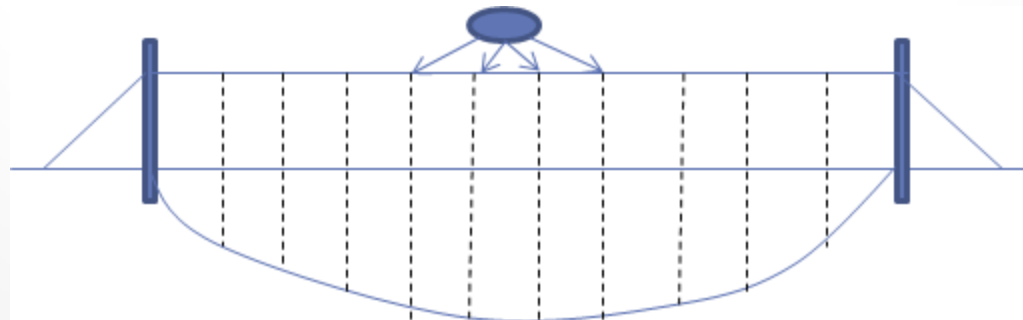


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Methods of Locating Soundings:

D) Location by distance along a wire or rope, stretched across stream between stations:

- In this method a wire or rope is stretched between fixed points on opposite banks and is marked by means of cloth or metal tags, at equal intervals along the rope or wire.
- The boat is rowed to these points and soundings are taken. This is most accurate but most expensive method. It is used when soundings are to be taken along the cross-section of a canal or narrow river.
- It is also used when it is required to determine the quality of material removed by dredging. The soundings are taken between and after dredging work is done.



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Assignment

Methods of Locating Soundings