EWCE-103

SURVEYING

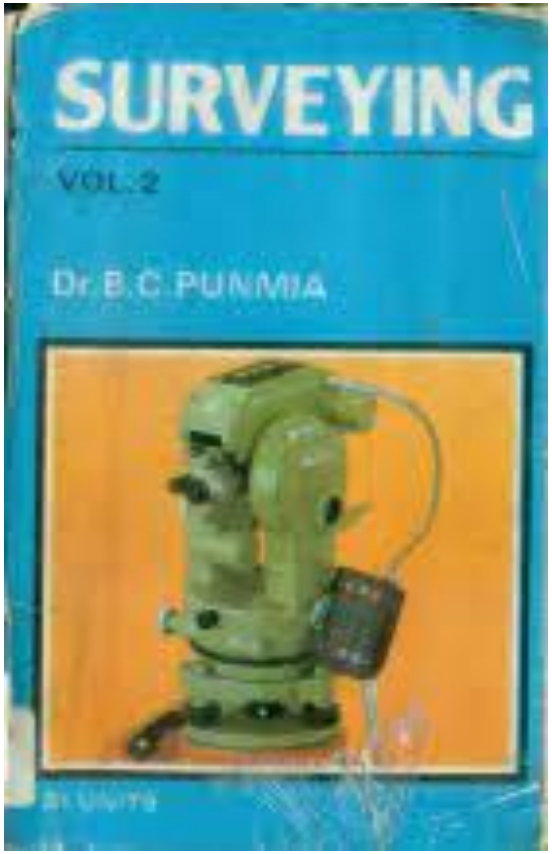
Syllabus

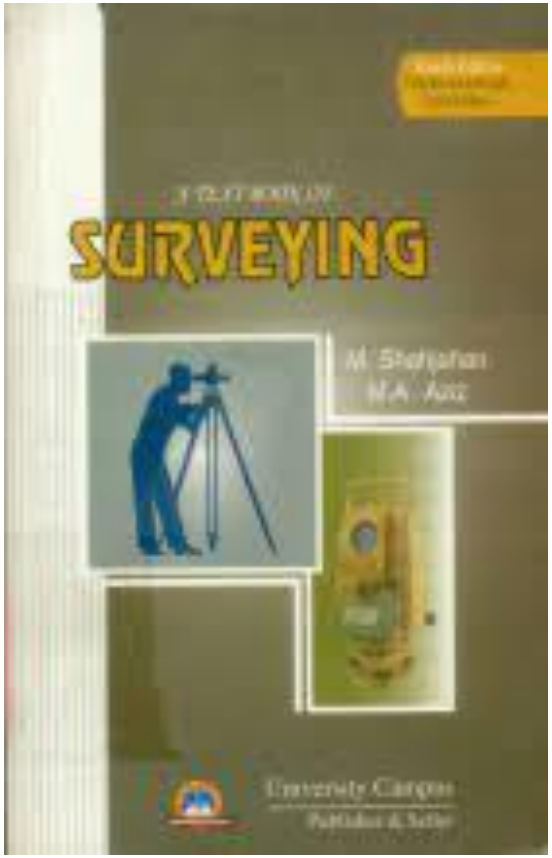
- Fundamentals
- Linear Measurement
- Chain Surveying
- Overview of Plane Table Survey
- Traverse Surveying
- Photogrammetry
- Astronomical Survey
- GIS, GPS and Remote Sensing
- Project Surveying

Reference

- **Surveying** (Volume 1,2 & 3) *by B C Punmia*
- **A Text Book of Surveying** *By M A Aziz & M Shahjahan*
- **Surveying and Levelling** *by N N Basak*
- **Basic Surveying** *by Ragnand Paul and Walter Whyte*
- **Construction Surveying and Layout**: A Step-by-Step Field Engineering Method *by Wesley G Crawford*

Reference





Fundamentals of Surveying



We are going to discuss today:

- Meaning of Survey and Surveying
- **Map and Plan**
- **Definition of Survey**
- Levelling
- **A few areas where surveying are used**.
- **Methods of surveying**
- Shape of the earth
- **Classification of Survey**

Meaning of Survey & Surveying

Survey

- Look closely at or examine (by someone or something).

Surveying:

- **Profession** or **work** of **examining and recording** the **area and features** of a piece of land/sky/sea so as to **construct a map**, **plan**, or **detailed description of it**.

Map

- A diagrammatic representation of an area of land or sea or sky showing **physical features**, **cities**, **roads**, etc.

- **Large area** with **small scale.**



Plan

- A **diagrammatic representation** of an area of land or sea or sky showing **physical features**, **cities**, **roads**, etc.

- **Small area** with **large scale**



Comparison between Plan and Map

Plan	Map
• Graphical representation to some scale of the features on, near or below the surface of the earth as projected on a horizontal plane.	• If the scale of the graphical representation on a horizontal plane is small. The plan is called a map.
• A plane is drawn on a **large scale**.	• **Small scale**
• Scale 1 cm= 10m 0r < 10m	• Scale 1 cm = 100m or > 100m.
• On a plan- **horizontal distance and direction.**	• On a topo map, **vertical distance**.
• Drawn for **small area** – house, bridge etc.	• Drawn for **large area**.

Definition of Survey

Definition of Surveying

Surveying is the **art and science** of determining the **relative positions** of points **on, above or beneath** the surface of the Earth/sea **by means of direct or indirect measurements** of **distance**, **direction** & **elevation** and **presenting them** on a piece of paper, known as plan or map.

Who is a surveyor?

A surveyor is a person who has **skills** of conducting survey as well as has **knowledge** of Physics, Mathematics and to some extent Astronomy

Fundamentals







A USGS field geologist uses ground-based electromagnetic surveying techniques to collect geophysical data in the Mojave Desert, California

Levelling

Levelling:

Branch of surveying which deal with the **measurements in a vertical plan.**

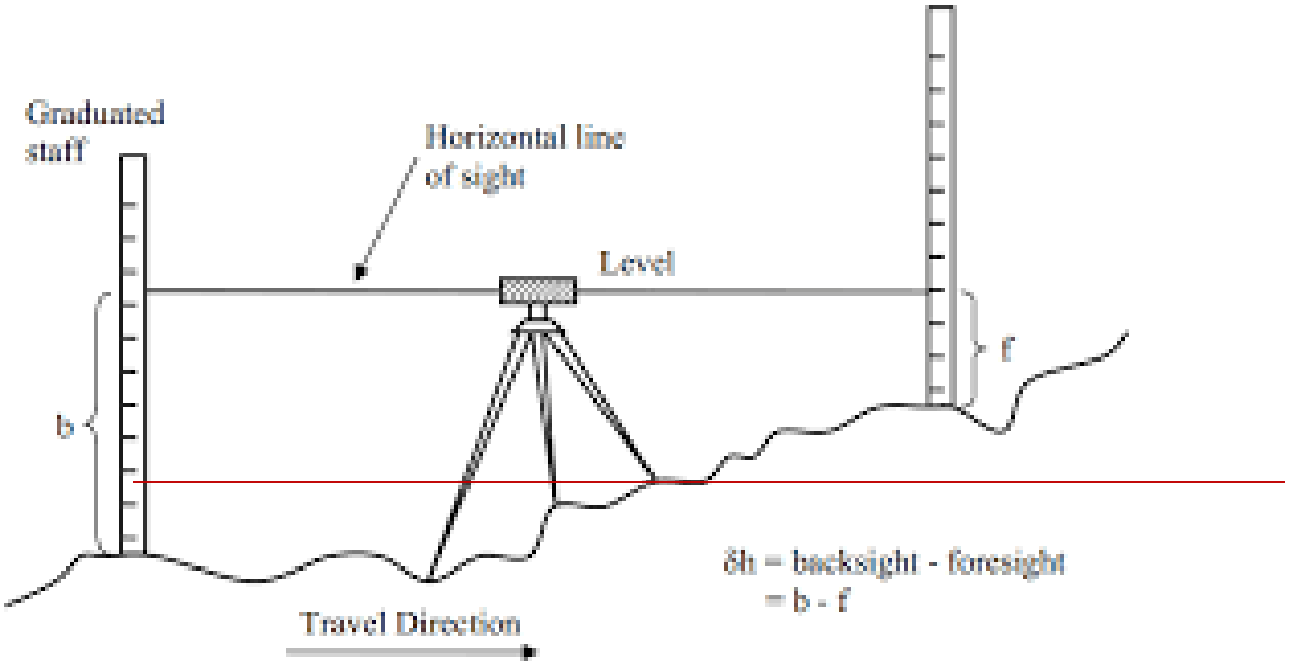
Purpose/Objective of levelling:

a. To **find the elevations** of points with respect to a given or assumed **datum**.

This operation is required to **enable** the **works to be designed.**






Graduated staff
Horizontal line of sight
Level
b
f
δh = backsight - foresight
= b - f
Travel Direction

Levelling (cont…)

Datum-

- It is a **reference system** or **approximation of the Earth's surface** against which **positional measurement are made** for **computing locations**. (An approximate definition of Sea level is the datum WGS 84).

b. To **establish points at a given elevation** or **at different elevations** with respect to a given or assumed datum.

This operation is required in the **setting out all kinds** of engineering works.

History

1. **Early Days of Surveying:**

a. **1400 BC- Egyptians** first used surveying to accurately **divide the land** into plots for the purpose of **taxation**.

b. **200 BC- Greeks** developed the **science of geometry** and were used it **for precise land divisions**.

-**Developed first** piece of survey equipment (Diopter).

-**Standardized** the procedures for conducting survey.

History

c. **1800 AD** - **Beginning of industrial Revolutions**.

-Importance of Exact Boundary and demand for Public Facilities (rails, roads, canals etc) brought the surveying in to a prominent position.

-More accurate survey equipment were developed .

-Methods of Geodetic and Plane Surveying were also developed.

History

- **1st Industrial Revolution** used water and **steam power (steam engine)** to mechanize production in 1765.
- **2nd** used **electric power (electricity, gas and oil)** to create mass production in 1870.
- **3rd** used **electronics and information technology (electronics, telecom and computers)** to automate production in 1969.
- **4th Industrial Revolution** is building on the 3rd, the **digital evolution (cyber physical system)** that has been occurring since the middle of the last century.

A few areas where surveying are being used

History

2. **Surveying Today**

Today surveying **affects most of the things in our daily lives**.

A few areas where surveying are being used:

a. To **map the Earth.**

b. To **prepare navigational map.**

c. To **established boundary** of public and private land.

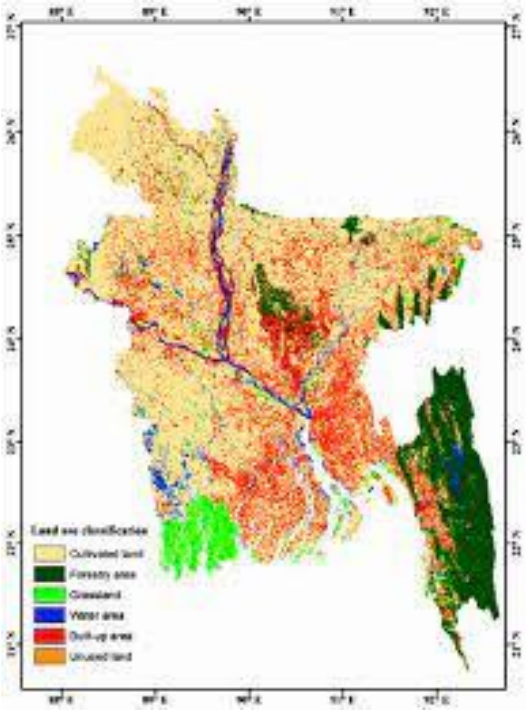
d. To **develop map for data bases** for natural resources etc for efficient management.

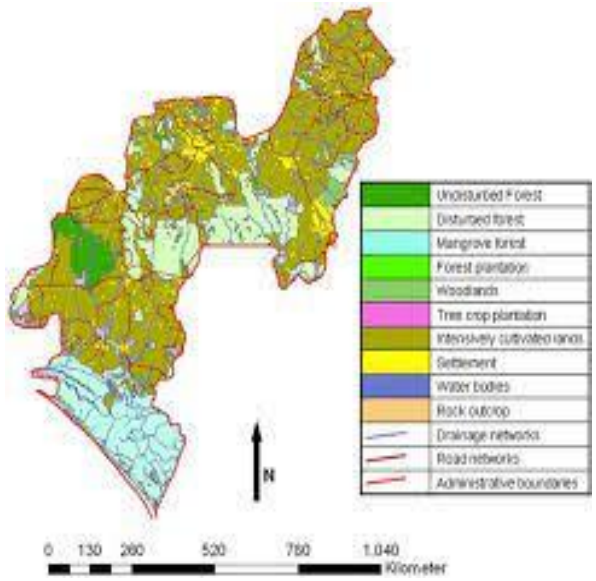
d. To **develop engineering data map.**

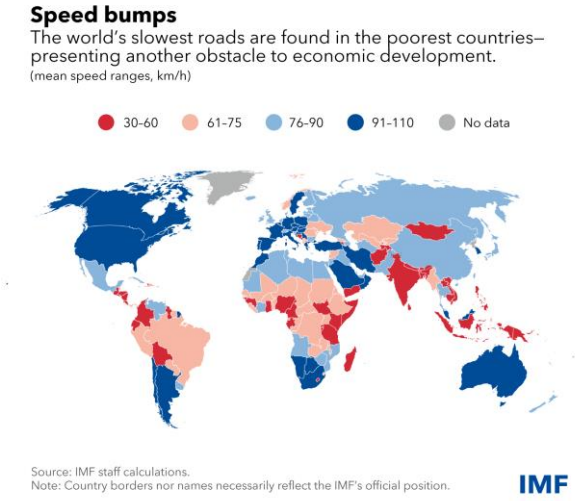
A **few areas** where surveying are being used











Methods of Surveying.

Methods of Surveying:

a. **Geodetic Surveying:**

-Takes into account the **actual shape of the Earth**.

-Generally high in accuracy and **covers a large areas** (more than 390 sq miles).

b. **Plane Surveying**

-Assumed that the surveying areas is a **flat plan**.

-Generally covers a **smaller areas**.

History

Where Surveying in Future?

Surveying in the early stage of revolutions, the **way data is collected, stored, retrieve and shared**; now-a-days as well as in future, **more sophisticated computers**, **optical equipment** and **satellites** are being used and will be used.

A comedian Says,

"A friend of mine once send me a post card with a picture of the entire planet, ie the earth taken from space. On the back, it said, **'wish you were here**'."

Purpose of Surveying

Purpose of Surveying:

a. Determine **the relative positions** of the existing features of the ground.

b. L**ayout the marked positions** of proposed structures on the ground.

c. Determine **the area, volumes and other related measurements**.

d. P**repare a map of a country** of detailed out locations of cities, towns, villages, major roads etc

e. P**repare engineering detailed plans and sections** of various aspects such as roads, railways, bridges, dams and other structures.

f. P**repare a topographical map** showing details of hills, valleys, rivers etc.

Understanding the shape of the Earth:

'**The Earth is oblate spheroid of revolutions**'.

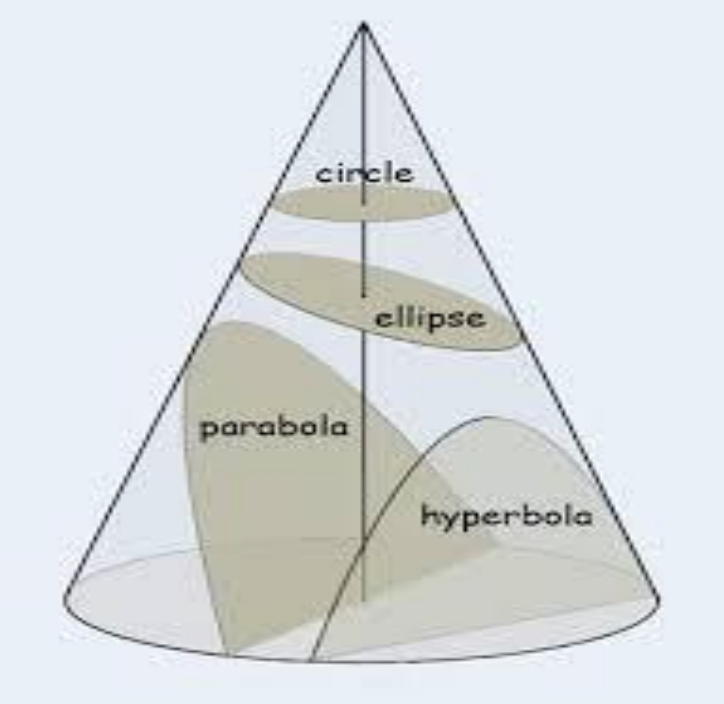
Oblate - Flattened at the poles

Spheroid - a sphere like, but not perfectly spherical body.

Oblate Spheroid Revolution- a solid generated by a revolution of an ellipse about its minor axis.

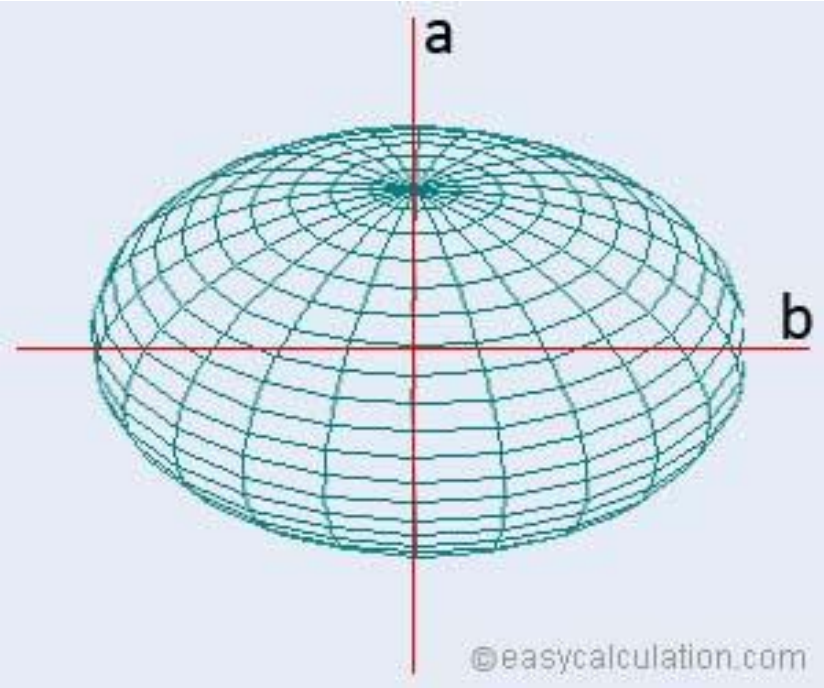
Ellipse-A regular oval shape.

-A cone is cut by an oblique plane



Oblate Spheroid :

- Oblate Spheroid is a surface of revolution and its formed by **rotating the ellipse on its polar axes (short axes).**
- It looks **like a sphere** but its not a perfect sphere.



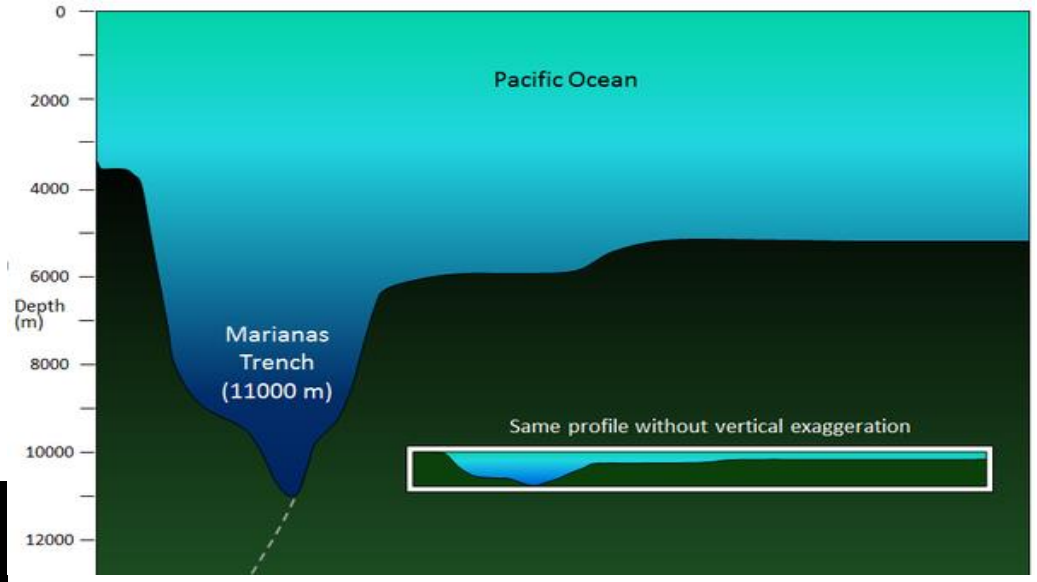
Shape of the Earth

Radius:

- at the equator: 6,378 km.

at the polar: 6,356 km—

a difference of 22 km.





Our planet as seen from space.
(Image: © NASA/JPL)



Shape of the Earth

Curved Surface:

- If we neglect the irregularities of the earth, the **surface of the imaginary spheroid is a curved surface**.

Level Line:

- **Portion of level surface** is called the level line.

A level line is a curved line normal to the plumb line at all the points.

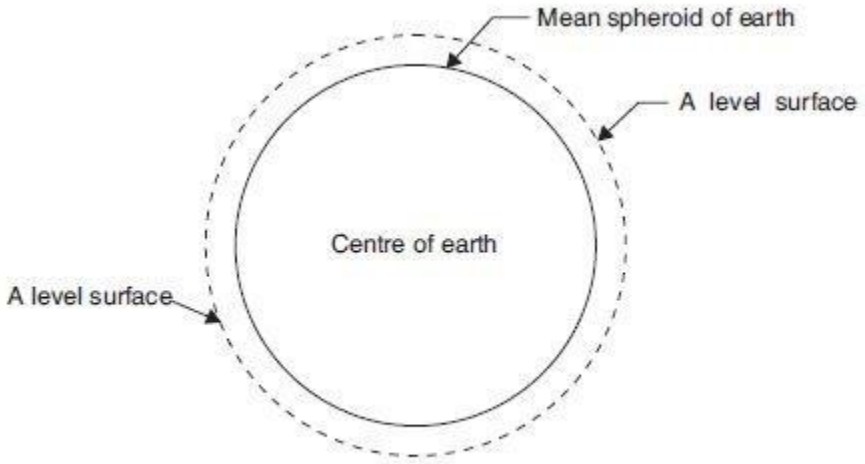


Fig. 15.1. A level surface

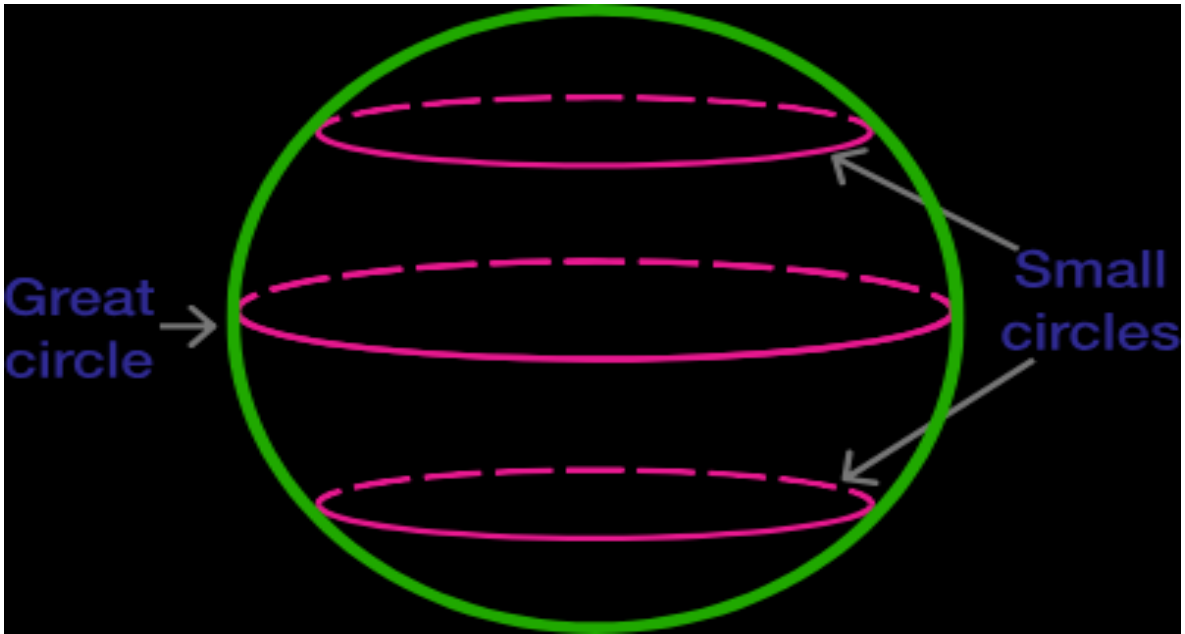




c. Great Circle:

- A great circle is any **circle that circumnavigates the earth and passes through the center of the earth.**

- A great circle always **divides the earth in half**, thus **Equator** is a great circle and all lines of **Longitude** are great circles.



Spherical Triangle

a. Consider three points A, B and C on the earth's surface. **Level lines** (curved lines) passing through these points.

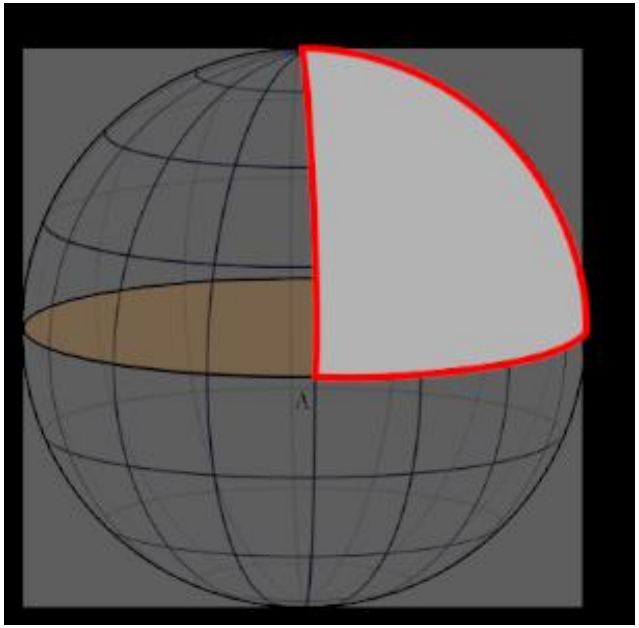
b. Surface within the triangle is so formed, is a curved surface and the **lines forming its sides** (arms), are the **arcs** of the great circles.

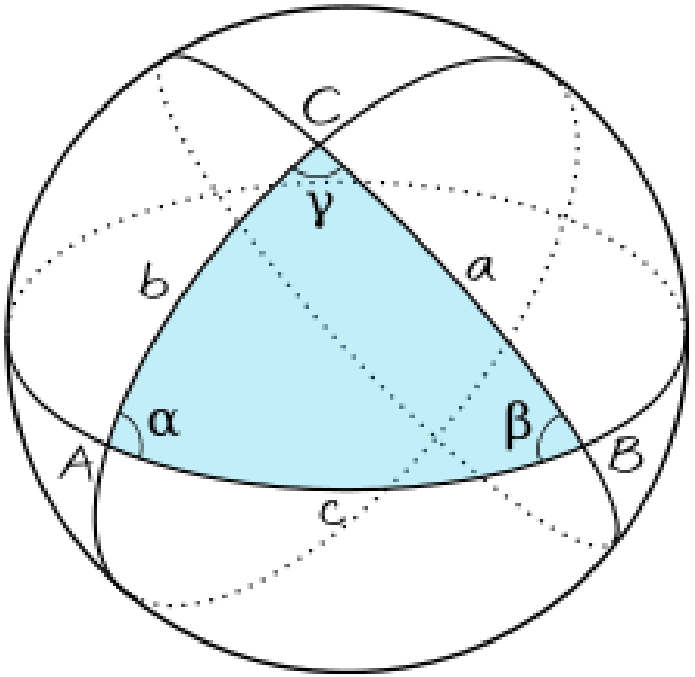
c. Figure is a **spherical triangles**.

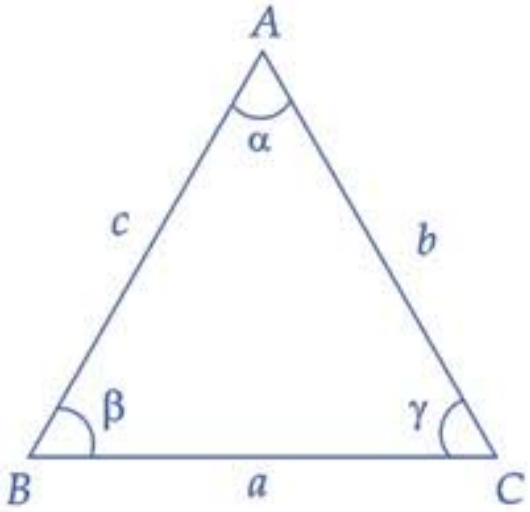
d. Angles A, B, C of spherical triangle are somewhat **greater than** A', B', C' of plane triangle.

e. If the **points are far away**, the differences will be considerable. If the **points are nearer**, the differences will be negligible.

Spherical & Plane Triangle







When Earth's Surface is Considered as Curved or Planed?

Methods of Surveying (cont..)

Whether the Earth's Surface is to be **considered** as **curved or plane** depends on the followings by the surveyor:

a. **Characteristic of the survey**

b. **Magnitude of the survey**

c. **Precision of the survey**

Primary divisions of Survey

Primarily, surveying can be divided into twos:

Plane Surveying:

a. Mean surface of the earth is plane.

b. Spheroidal shape is neglected.

c. All triangles formed by the survey lines are plane triangles.

d. **Level lines** are straight and plumb lines are parallel.

Primary divisions of Survey (cont..)

- Length of an **arc of 12 kms** long lying on the earth surface **is only 1 cm greater** than the subtended chord.

- Differences between the **sum of the angles in plane triangle** and sum of those spherical triangle is **only 1° for** a triangle at the earth's surface having an **area of 195 Sqkm**.

Primary divisions of Survey

Geodetic Surveying:

a. Shape of the earth is taken into account.

b. All triangles are the spherical triangles.

c. Involves spherical trigonometry.

d. Survey includes works of larger magnitude and precision.

Objective of Geodetic Survey:

To determine the precise positions on the surface of the earth, at widely distant points which **form the control stations**, to which surveys of lesser precision may be referred.

Classification of Survey

Classifications of Survey

Survey may be classified basing on the uses and purposes of the resulting map.

Based on the nature of Field Survey

- **Land Survey**.
- Marine Survey
- Astronomical Survey

Classifications of Survey (cont…)

Land Survey.

- **Topographical Survey**

  -Consists of horizontal and vertical location of certain points by linear and angular measurements, and is made to determine the natural as well as artificial features.

- **Cadastral Survey**

  -Fixing property lines

  -Calculation land areas

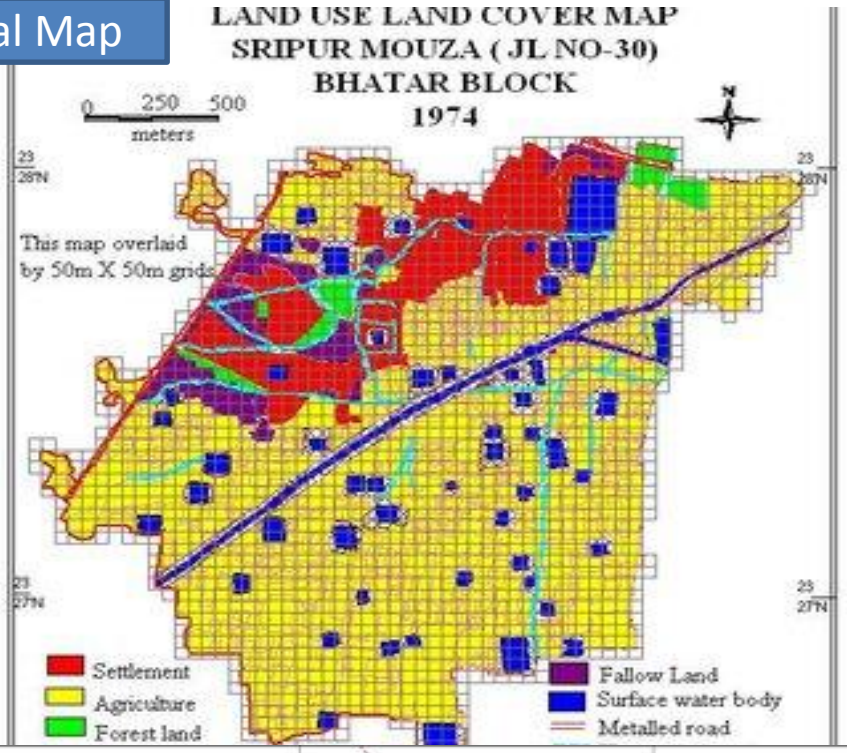
  -Transferring the land property from one owner to another.

  -Fixing boundary of municipalities, state, provinces and federal jurisdictions etc.

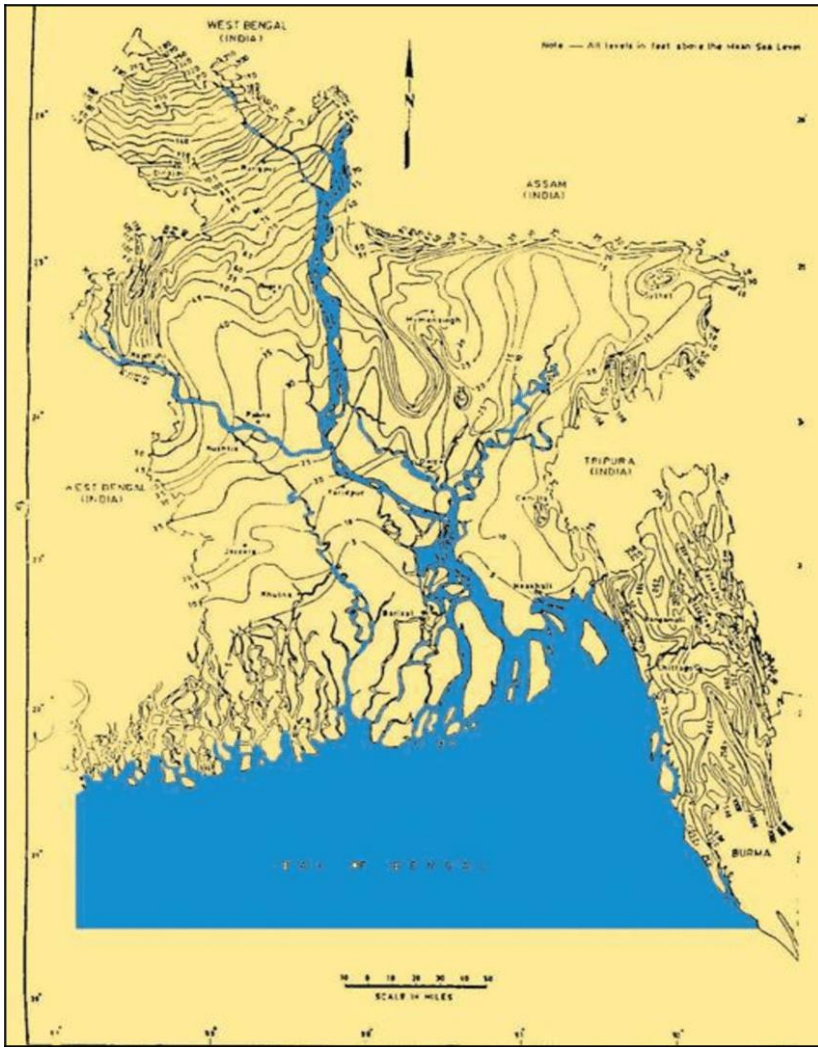
- **City Survey**

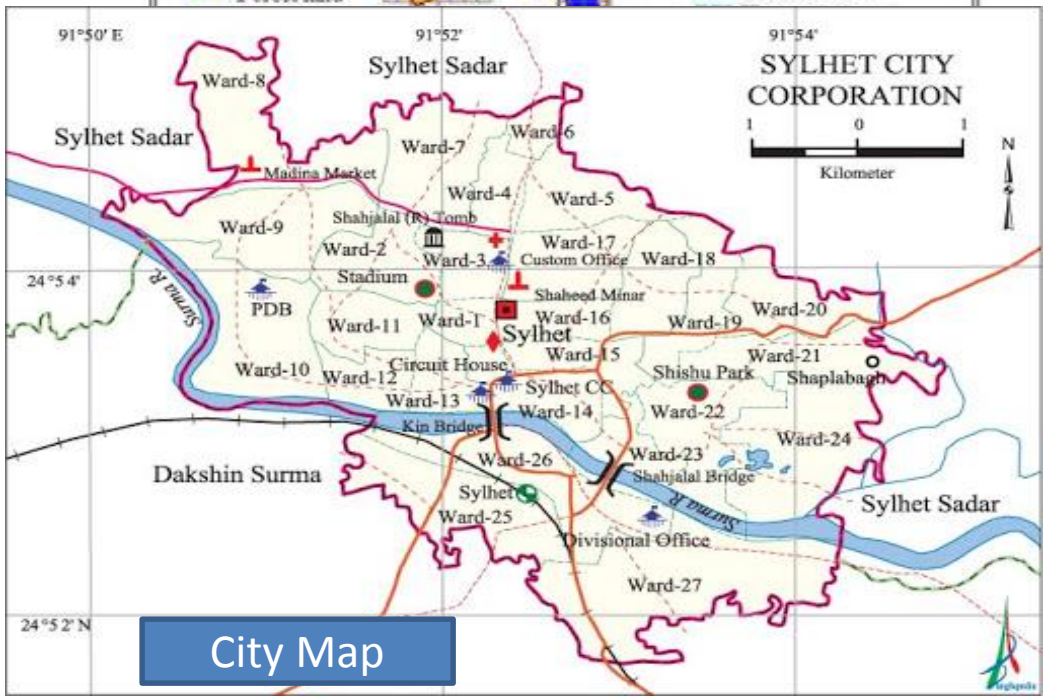
  - Constructing streets, water supply system, sewerage lines etc.

Cadastral Map



Topo Map of Bangladesh





City Map

Classifications of Survey (cont..)

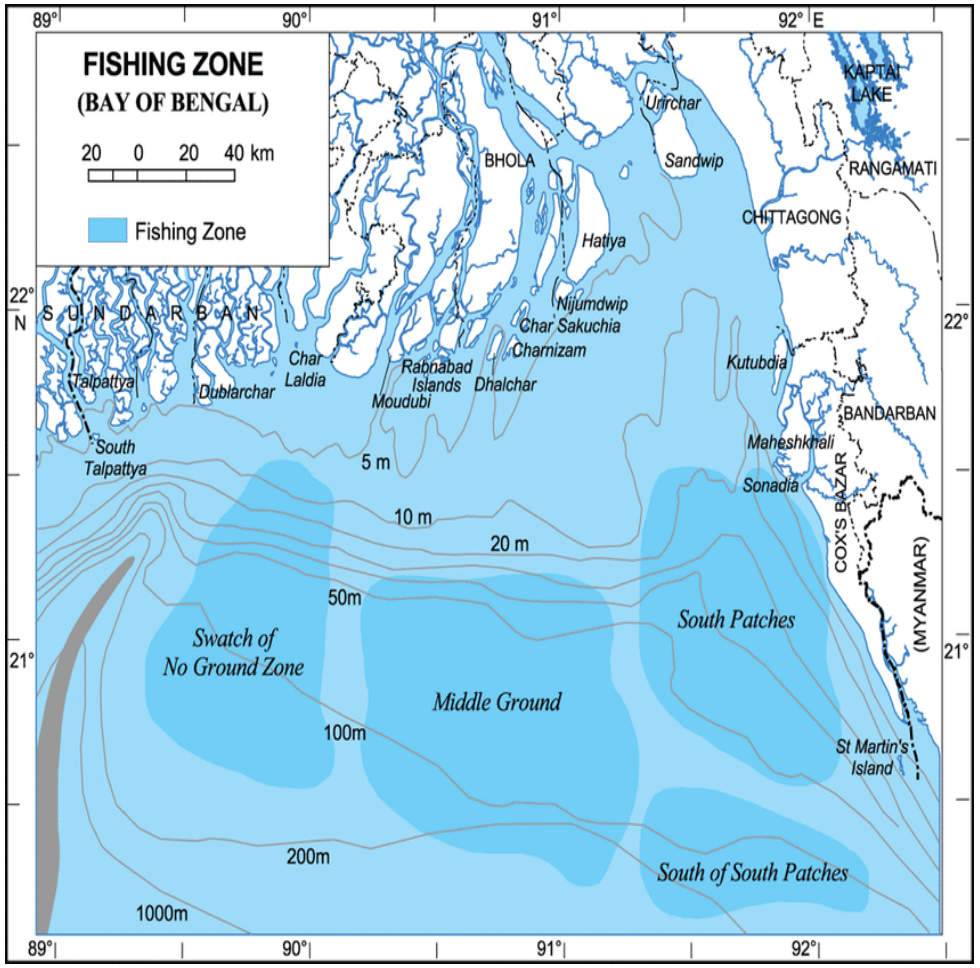
Marine Survey:

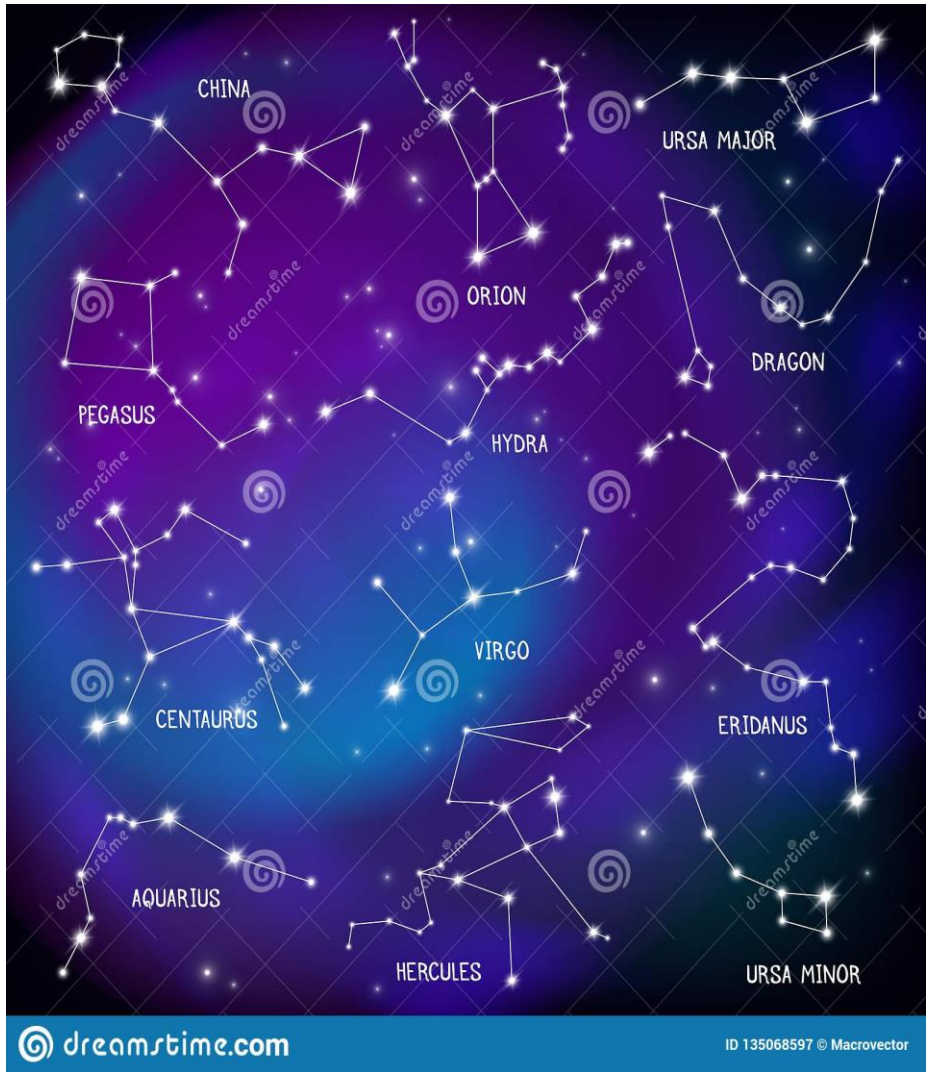
- Deals with the **boundary of water body** for the purpose of navigations, water supply, harbor works, determination of mean sea level etc.

- Works consists of measurement of the discharge of the streams, topography of shores and banks, fluctuations of tide etc.

Astronomical Survey:

- Refers to the fact that it is to **survey a particular area of sky**, just the same as an ordinary survey of a particular land.


FISHING ZONE
(BAY OF BENGAL)
20 0 20 40 km
Fishing Zone
89°
90°
91°
92° E
22° N
21°
KAPTAI LAKE
Urirchar
Sandwip
BHOLA
RANGAMATI
CHITTAGONG
Hatiya
Nijumdwip
Char Sakuchia
Charnizam
Kutubdia
SUNDARBAN
Talpattya
Dublarchar
Char Laldia
Rabnabad Islands
Moudubi
Dhalchar
BANDARBAN
Maheshkhali
Sonadia
South Talpattya
5 m
10 m
20 m
50m
100m
200m
1000m
COX'S BAZAR
(MYANMAR)
Swatch of No Ground Zone
Middle Ground
South Patches
South of South Patches
St Martin's Island


CHINA
URSA MAJOR
ORION
DRAGON
PEGASUS
HYDRA
VIRGO
CENTAURUS
ERIDANUS
AQUARIUS
HERCULES
URSA MINOR
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Thank You