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Topic 1: Introduction

Contents

- ✓ Brief Background of surveying
- ✓ Definitions
- ✓ Surveying Units and Coordinate Systems
- ✓ Errors and standards of accuracy

Survey Units and Coordinate Systems

- The purpose of surveying is to find the relative positions of points in two/three dimensions; These positions of points may be defined by means of coordinates in a coordinate system
- Thus it is useful to express the 3D positions of points near the earth's surface in terms of latitude, longitude and height (Geographic coordinates) above some surface which represent the earth.
- ***However, maps and plans are made as a plane reproduction of the 3D earth!***
- Therefore there should be a projection system to reproduce the earth onto the plane since the earth is spheroidal in shape. The system should:
  - *should give a precise and straightforward definition of any point's location, in terms of parameters (east, north and height) which are convenient to use everywhere around the world.*
  - *Thus permitting the computations of distances, area and angles.*

Survey Units and Coordinate Systems

It is **not possible** to project a doubly curved surface onto a planar or developable surface in such a way that the scale of the projection is unity (or any other constant value) at all places.

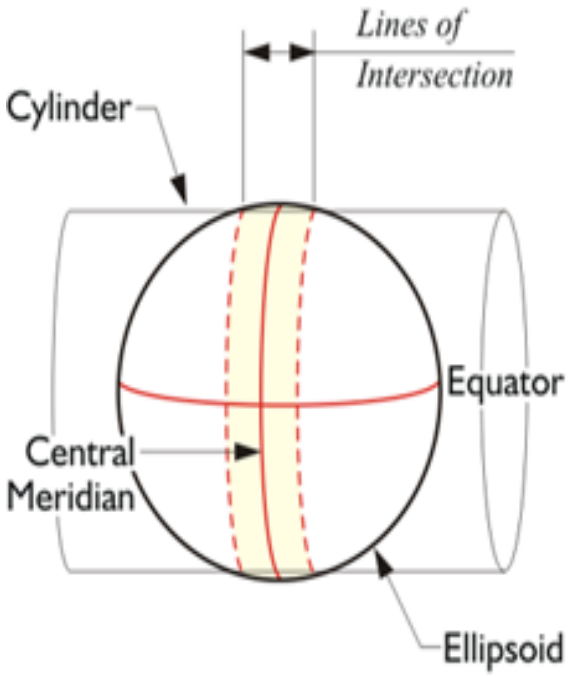
Thus, all such projections involve some degree of distortion on the resulting map, except at certain points or along particular lines.

By varying the exact method of projection, it is possible to manipulate the changes in scale so as to avoid some aspects of distortion on a map, but usually at the expense of increased distortion in other respects. In particular, there are three important properties which maps may have; they are as follows:

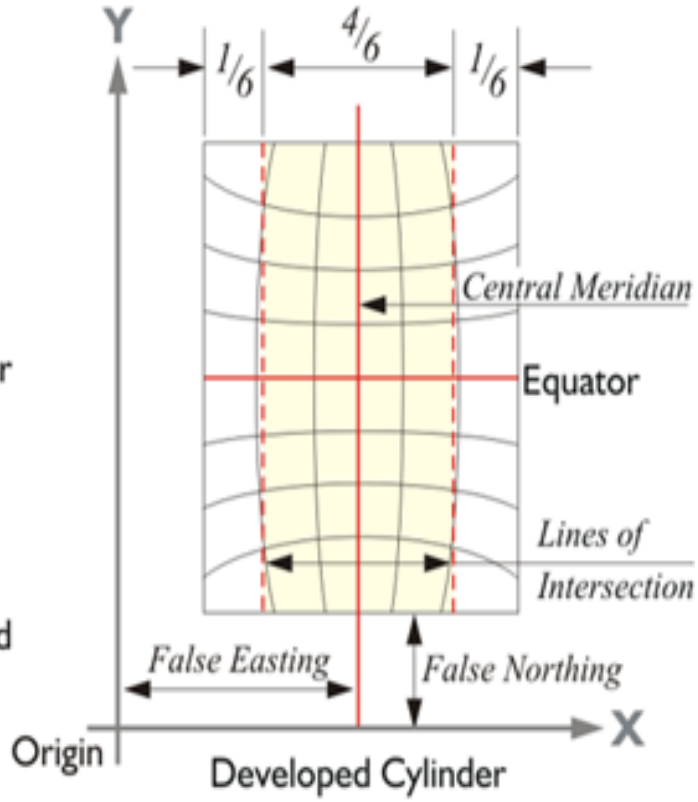
Coordinate Systems

- By now understand that the earth is NOT flat but Spherical. Question: If the earth is spherical, how are plans/maps flat?
- Maps are made as a plane reproduction of the earth, and this leads to what is termed as projection system to reproduce the earth on the plane in the most accurate with least distortion.
- For this reason, we have a number of projection systems suitable for different parts of the world and different use.
- In Zambia, Universal Transverse Mercator (UTM) is used. Imagine a sphere wrapped in a cylinder then split open.

Coordinate Systems - UTM



Transverse Mercator Projection



Specifications:
Units: metre

Orientation:
Easting (E) =
Positive to the East,
Negative to the West

Northing (N) =
Positive to the North,
Negative to the South

Therefore, a point P may be defined as P(E,N) = P(1000m, 1000m).

Survey Units and Coordinate Systems

The SI-system is an international system for measurements. The units of SI-system are applied to surveys in Zambia.

Units of lengths

Basic SI-units:	1 metre (m)	
Derived units:	1 kilometre (km)	= 1 000 m
	1 decimetre (dm)	= 0.1 m
	1 centimetre (cm)	= 0.01 m
	1 millimetre (mm)	= 0.001 m

Survey Units and Coordinate Systems

The SI-system is an international system for measurements. The units of SI-system are applied to surveys in Zambia

Units of lengths

The British System:

1 Chain = 66 English Feet

1 English Foot (ft) = 0.304799472 m

= 0.968061218 Cape Feet

= 0.080671768 Cape Roods

Survey Units and Coordinate Systems

The SI-system is an international system for measurements. The units of SI-system are applied to surveys in Zambia

Units of Area

SI – units:

$$1\ Square\ Metre = 1m^2 = 1m \times 1m$$

$$1\ Hectare = 1\ ha = 100m \times 100m = 10\,000m^2$$

The British System:

1 Acre = 0.40468 ha

1 Square Mile = 640 Acres

- ***The unit of measure for area is the hectare or square metre according to the land survey regulations***
- ***When the area is greater than*** $10\,000\mathrm{m}^2$***, it should be expressed in hectares***

Survey Units and Coordinate Systems

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Units of Angles

The Sexagesimal System:

$The\ whole\ circle\ = 360\ degrees\ (360°)$

$1\ ° = 60\ minutes = \ (60')$

$1' = 60\ seconds = 60"$

The Centesimal System:

$The\ whole\ circle\ = 400\ grades = 400^{g}$
$= (400\ gon)$

$1\ grade\ = 100\ cent.minutes\ = 100^{C}$

$1^{C} = 100\ cent.seconds = 100^{CC}$

Radians System:

$$The\ whole\ circle\ = 2\,\pi\ radians$$

- ***The system of measurement for angles and angles of direction is the sexagesimal system according to the regulations***