Position

Engineering surveying is concerned essentially with fixing the position of a point in two or three dimensions.

For example, in the production of a plan or map, one is concerned in the first instance with the accurate location of the relative position of survey points forming a framework, from which the position of topographic detail is fixed. Such a framework of points is referred to as a control network.

The same network used to locate topographic detail may also be used

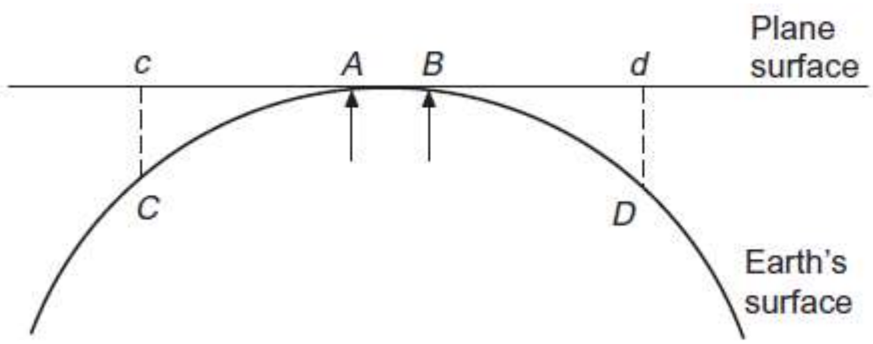
1- To set out points, defining the position, size and shape of the designed elements of the construction project.

2- Precise control networks are also used in the monitoring of deformation movements on all types of structures.

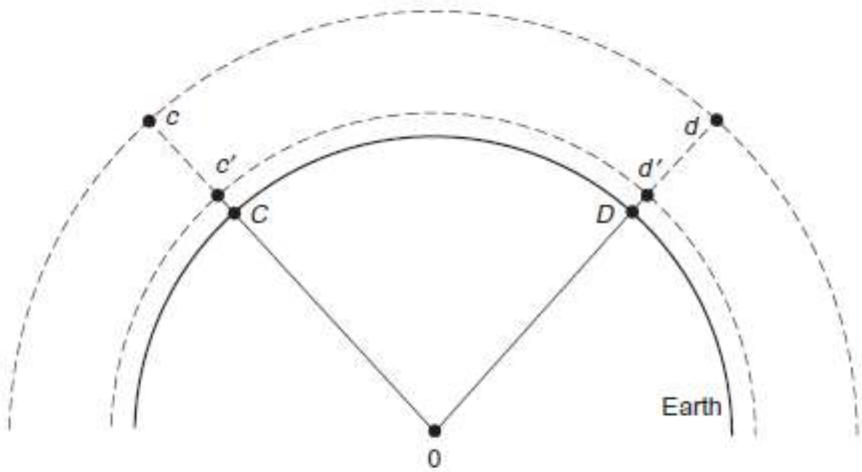
In all these situations the engineer is concerned with relative position, to varying degrees of accuracy and over areas of varying extent. In order to define position to the high accuracies required in engineering surveying, a suitable homogeneous coordinate system and reference datum must be adopted.

Consideration of Figure below illustrates that if the area under consideration is of limited extent, the orthogonal projection of ***AB*** onto a plane surface may result in negligible distortion. Plane surveying techniques could be used to capture field data and plane trigonometry used to compute position.

This is the case in the majority of engineering surveys. However, if the area extended from ***C*** to ***D***, the effect of the Earth's curvature is such as to produce unacceptable distortion if treated as a flat surface. It can also be clearly seen that the use of a plane surface as a reference datum for the elevations of points is totally unacceptable.



If Figure 5.2 is now considered, it can be seen that projecting CD onto a surface (cd) that was the same shape and parallel to CD would be more acceptable. Further, if that surface was brought closer to CD, say c^- d^-, the distortion would be even less. This then is the problem of the geodetic surveyor: that of defining a mathematical surface that approximates to the shape of the area under consideration and then fitting and orientating it to the Earth's surface. Such a surface is referred to in surveying as a 'reference ellipsoid.



COORDINATE SYSTEMS:

1- Astronomical coordinates

As shown in Figure below, astronomical latitude ϕ_A defines the latitude of the vertical (gravity vector) through the point in question (***P***) to the plane of the equator, whilst the astronomical longitude Λ_A is the angle in the plane of the equator between the zero meridian plane (Greenwich) and the meridian plane through (***P***), both of which contain the spin axis.

Astronomical latitude and longitude do not define position on the Earth's surface but rather the direction and inclination of the vertical through the point in question. Due to the undulation of the equipotential surface it is possible to have verticals through different points which are parallel and therefore have the same coordinates. An astronomical coordinate system is therefore unsatisfactory for precise positioning.