Principles and Techniques of Plane Table Surveying

Introduction

Plane table surveying is a graphical method of surveying where field observations and plotting are done simultaneously. It consists of a drawing board mounted on a tripod with an alidade (sighting rule) for taking observations.

Basic Principles

The fundamental principle is that the lines of sight are plotted directly on the drawing sheet in their actual positions, eliminating the need for field notes. The table must be properly oriented so the lines drawn on paper are parallel to the corresponding ground lines. This method provides a map or plan directly from field work.

Essential Equipment

- **Drawing Board**: A well-seasoned wooden board with a smooth surface
- **Alidade**: A straight-edge ruler with sights for line-of-sight observations
- **Tripod**: Provides stable support with adjustable legs
- **Trough Compass**: For orientation purposes
- **Spirit Level**: Ensures the table is horizontal
- **Plumbing Fork**: For centering the table over ground stations

Main Techniques

1. Radiation Method: Used for locating details from a single station. The table is set up at one point, and rays are drawn to various objects. Distances are measured and plotted to scale.

2. Intersection Method: Employed when points are inaccessible. The table is set at two stations, and rays are drawn to the object from both positions. The intersection locates the point.

3. Traversing Method: The table is moved from station to station along a traverse. Each line is plotted as the survey progresses, suitable for route surveys.

4. Resection Method: Used to locate the instrument's position by sighting known points. The three-point problem and two-point problem are common applications.

Field Procedure

First, level the table using the spirit level and orient it either by compass or by backsighting. Mark the station points on the sheet and ensure proper centering over the ground point. Draw rays to objects using the alidade, measure distances, and plot points to scale. Check work frequently through tie lines and intersections.

Advantages and Limitations

Advantages: No field book required, plotting errors detected immediately, suitable for magnetic areas, ideal for filling details, and excellent for preparing contour maps.

Limitations: Not suitable in wet weather, less accurate than theodolite surveying, heavy and cumbersome equipment, and difficult to work in wooded or crowded areas.

Principles and Techniques of Prismatic Compass Surveying

Introduction

The prismatic compass is a magnetic surveying instrument used primarily for measuring horizontal angles and bearing of survey lines. It derives its name from the prism attached to the line of sight, allowing simultaneous observation of the object and compass reading.

Working Principle

The instrument works on magnetic principles, where a magnetized needle always points toward magnetic north-south. The bearing of a line is measured as the horizontal angle between the magnetic meridian and the survey line. The prismatic compass measures whole circle bearings (0° to 360°) in a clockwise direction.

Components and Construction

- **Compass Box**: Circular non-magnetic metal box containing the pivot and needle
- **Magnetic Needle**: Broad lightweight needle with agate cap at center
- **Graduated Circle**: Attached to the needle, numbered from 0° to 360°
- **Prism**: Allows reading of graduations while sighting the object
- **Object Vane and Eye Vane**: For accurate sighting of stations
- **Lifting Pin**: Lifts the needle off the pivot when not in use
- **Tripod**: Provides stable support during observations

Bearing System

The compass reads **whole circle bearings (WCB)** measured clockwise from north (0°) through east (90°), south (180°), and west (270°) back to north (360°). The graduations run anti-clockwise on the circle because the observer views them through the prism while the circle rotates with the needle.

Field Techniques

1. Taking Observations: Set up the compass over the station, level it, release the magnetic needle, sight the object through vanes, and read the bearing through the prism when the needle settles.

2. Fore Bearing and Back Bearing: The fore bearing is measured while sighting forward along a line. The back bearing is measured from the opposite direction and should differ from the fore bearing by exactly 180°. This provides a check on observations.

3. Included Angles: Can be calculated from bearings using the formula: Included angle = Difference of bearings or 360° - Difference of bearings (whichever is less than 180°).

Sources of Error

Local Attraction: Magnetic influences from iron objects, electric cables, or magnetic ore deposits deflect the needle from true magnetic meridian. Detected when fore and back bearings differ by exactly 180°.

Magnetic Variation/Declination: The angle between true meridian and magnetic meridian varies with location and time.

Applications

Prismatic compass is extensively used for reconnaissance surveys, preliminary traverse surveys, small-scale mapping, geological and forest surveys, and military operations where quick bearing measurements are essential.

Advantages

Portable and lightweight, quick observations possible, suitable for rough terrains, whole circle bearing system reduces confusion, and adequate accuracy for many engineering projects.