

Time Optimization in Reconnaissance Surveying

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Abstract -Number of operations in Surveying requires different instruments. While plotting a traverse, ranging rods are required for ranging, tape is used for linear measurements and theodolite is used for angular measurements. To avoid transportation and haulage of different instruments on site, we have manufactured a new instrument which has united all these operations by single set up. This instrument is able to perform different functions i.e. ranging, levelling, traverse plotting, angular measurements simultaneously. This invention consist of a ranging rod with metallic tape attached at bottom of rod, 360 degree protractor as main scale and vernier scale is provided to measure the horizontal angle between any two points to an accuracy of 20 seconds. With the help of this instrument, we are able to measure vertical angles and bearing of survey lines.

Key Words: Transverse plotting, ranging, reconnaissance, theodolite

1.INTRODUCTION

Surveying has been an element in the development of human environment since the beginning of recorded history. As it is the first step before planning and execution. It is also used in transport, communication, mapping, and other definitions of legal boundaries for land ownership.

It is an important tool for research in many other scientific discipline. Various surveying devices are used to carry out the survey of large stretch of land. Commonly used instruments are total station, theodolite, auto level, dumpy level, prismatic compass, measuring tape etc. Most precise and mostly used instrument is total station but it is very costly as compared to other instruments hence it limits its use in extensive projects only. For small projects theodolite is mostly preferred. Theodolite is used to measure horizontal as well as vertical angles. Auto levels and dumpy levels are used to measure the elevation of the different levels of the ground. Prismatic compass is used to measure bearings of the angles. Measuring tape is used to measure distance between two points. we have combine characteristics of these instruments to construct a new instrument which will measure horizontal, vertical angles, level difference, bearings of line, plotting of offsets as well as horizontal distances on ground simultaneously which improves the speed of the surveying and the instrument is economical as compared to other conventional instruments.

2. COMPONENTS OF INSTRUMENT

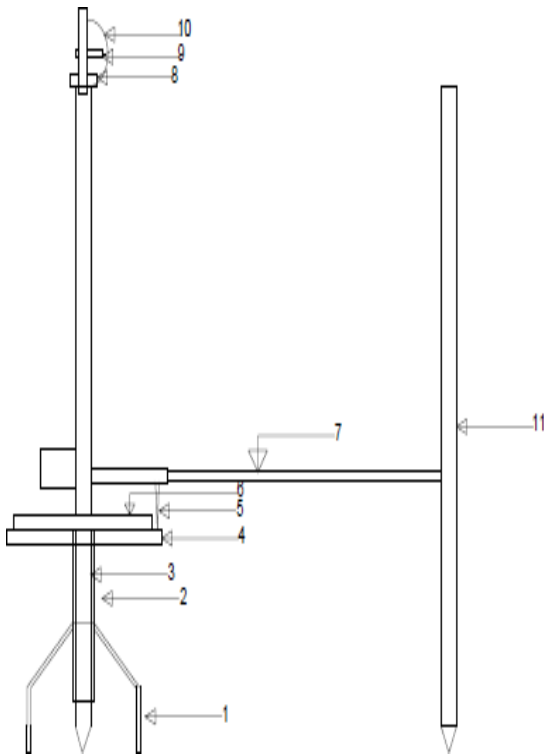


Fig No. 1. Schematic representation of Instrument

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1. Base stand
2. Fixed rod
3. Rotating rod
4. Main scale
5. Needle
6. Vernier scale
7. Measuring tape
8. Trough compass
9. Telescope
10. Protractor
11. Ranging rod -2

3. PROCEDURE OF MEASURING HORIZONTAL ANGLE

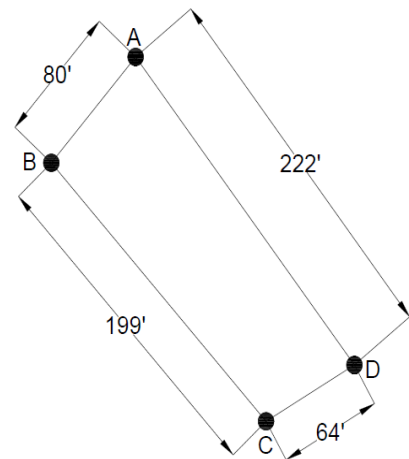
There are two ranging rods connected to each other by means of measuring tape. By placing one ranging rod at station a second rod is moved to the station B. While moving second rod vernier scale moves over main scale and pointer guides the angle on the main scale. In this way angle between two points can be measured.

4. PROCEDURE OF MEASURING VERTICAL ANGLE

Vertical circle is provided at the side of the telescope for measurement of vertical angle. Pointer is attached to denote the angle. As we rotate the telescope the needle rotates around the semicircular protractor to measure the vertical angle between two points. By knowing vertical angle between two points by using trigonometric calculations we can find out the level difference between two points.

5. CASE STUDY

We carried out the measurement of irregular plot with the help of theodolite and our instrument for the purpose of validation. We consider a following map for the measurement of area. We measured sides of quadrilateral with the help of measuring tape and measured the angles with the help of theodolite. Then we measured sides and angles of the quadrilateral with our instrument and validate the result as follows:



Area measured using Theodolite	14876 sq. feet
Area measured by our instrument	14875.09 sq feet

6. ADVANTAGES OF INSTRUMENT



- **Cost of Instrument:** The cost of this instrument is Rs.4, 500/- only which is very small as compared to other surveying instruments.
- **Functions:** This instrument can perform ranging, linear measurement, measurement of horizontal and vertical angles, centering, determination of level difference simultaneously.
- **Transportation of Instrument:** Easy to transport since this instrument takes very less time for its mantling and dismantling.
- **User friendly:** Non-technical person can use this instrument very easily.

7. POSSIBLE FIELDS OPERATIONS

- **Area Measurement:** It can be used to calculate the area of the irregular plot by measuring the lengths of the sides and angles between the sides.
- **Level Difference:** By observing vertical angle between two points and by using trigonometric calculations we can find out the level difference.
- **Traverse plotting:** It can be used to plot closed as well as open traverse.
- **Ranging:** Ranging can be done conveniently with main scale fixed at bottom.
- **Measurement of Linear Distances**
- **Bearing of survey line**

8. CONCLUSIONS

- Least count of this instrument is 20 seconds therefore results obtained from this instrument are competent with 20 second theodolite.
- This instrument has replaced use of various equipment's in reconnaissance survey by combining 6 functions in single set up.
- Use of this instrument is limited for reconnaissance survey only.

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