EWCE-103

SURVEYING

What we are going to learn today?

- Precision and Accuracy
- Discrepancy and Error
- Sources of Error
- Classification of Error

Accuracy, Precision and Error

What is Precision?

• Precision-is the **degree of perfection used** in the instruments, methods and the observations.

What is accuracy?

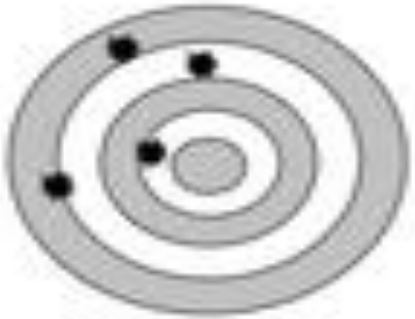
Accuracy- is the **degree of perfection obtained**.

Question: What do you understand the terms, Precision and Accuracy as applied to surveying measurements and observations?

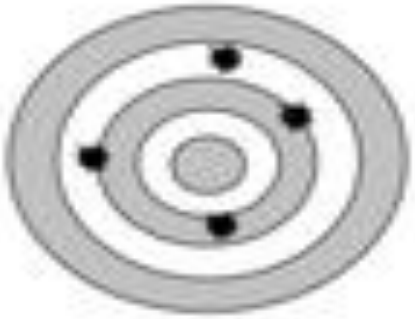
Accurate and perfect

Four hits together -Precise

Four hits around center- **Perfect**



Not Accurate
Not Perfect



Accurate
Not Perfect



Not Accurate
Perfect



Accurate
Perfect

Four sets of **rifle shots illustrate the distinction** that surveyors make between the terms **"accuracy"** and **"precision**," as applied to surveying **measurements** and **observations**.

Accuracy depends on certain things in surveying:

- **Precise Instruments** which simplify the works, save time.

- **Precise Methods** which eliminate or try to reduce the effects of all types of errors.

- **Good planning** includes proper choice and methods of survey controls, instruments and methods.

Question: How do achieve accuracy in your survey works?

Accuracy and Errors (cont..)

- **True Error**: Difference between a **measurement** and **a true value of the quantity** to be measured. but true values are never known.

- **Important function of a surveyor is:** To **secure the measurements** which **are correct within certain limit of errors prescribed** by the nature and purpose of particular survey.

Question: Write down the important function of a surveyor.

Discrepancy in surveying:

- **Difference between two measured values** of the same quantity.
- It is **not an error**.
- **Discrepancy may be small**, but **error may be great** if each of the two measurements contain error, that may be large.
- Does not reveals the magnitude of systematic errors.

Question: What is discrepancy in surveying?

Accuracy and Errors

Error:-

- Difference between the **observed value** and the **designed value** is known as error.

- **Three types of errors** which occurs while we do the surveying:

  -Instrumental error

  -Personnel error

  -Natural error

Sources of Errors in surveying:

- **Instrumental error**: Due to **imperfection and faulty adjustment** of the equipment.

- **Personnel error:** Due to **imperfection of human sight** in observing **and human touch** of manipulating the instrument.

- **Natural Error**: Due to **variation due to natural phenomenon** such as temperature, humidity, gravity, wind, refraction, magnetic declination etc.

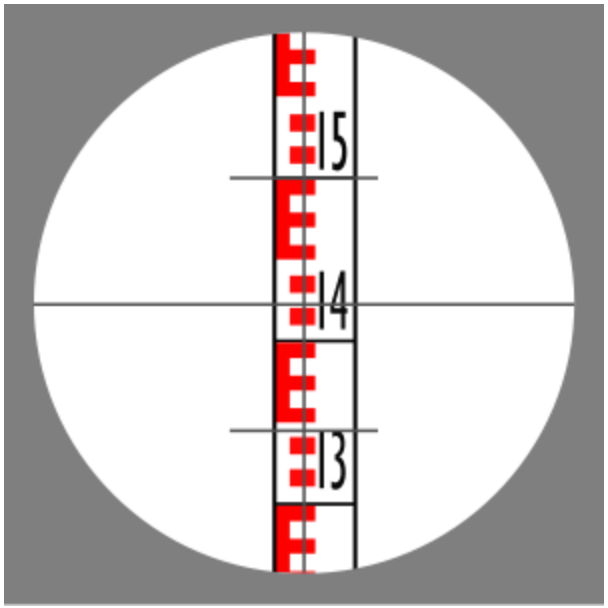
Question: Describe the different sources of errors in surveying.

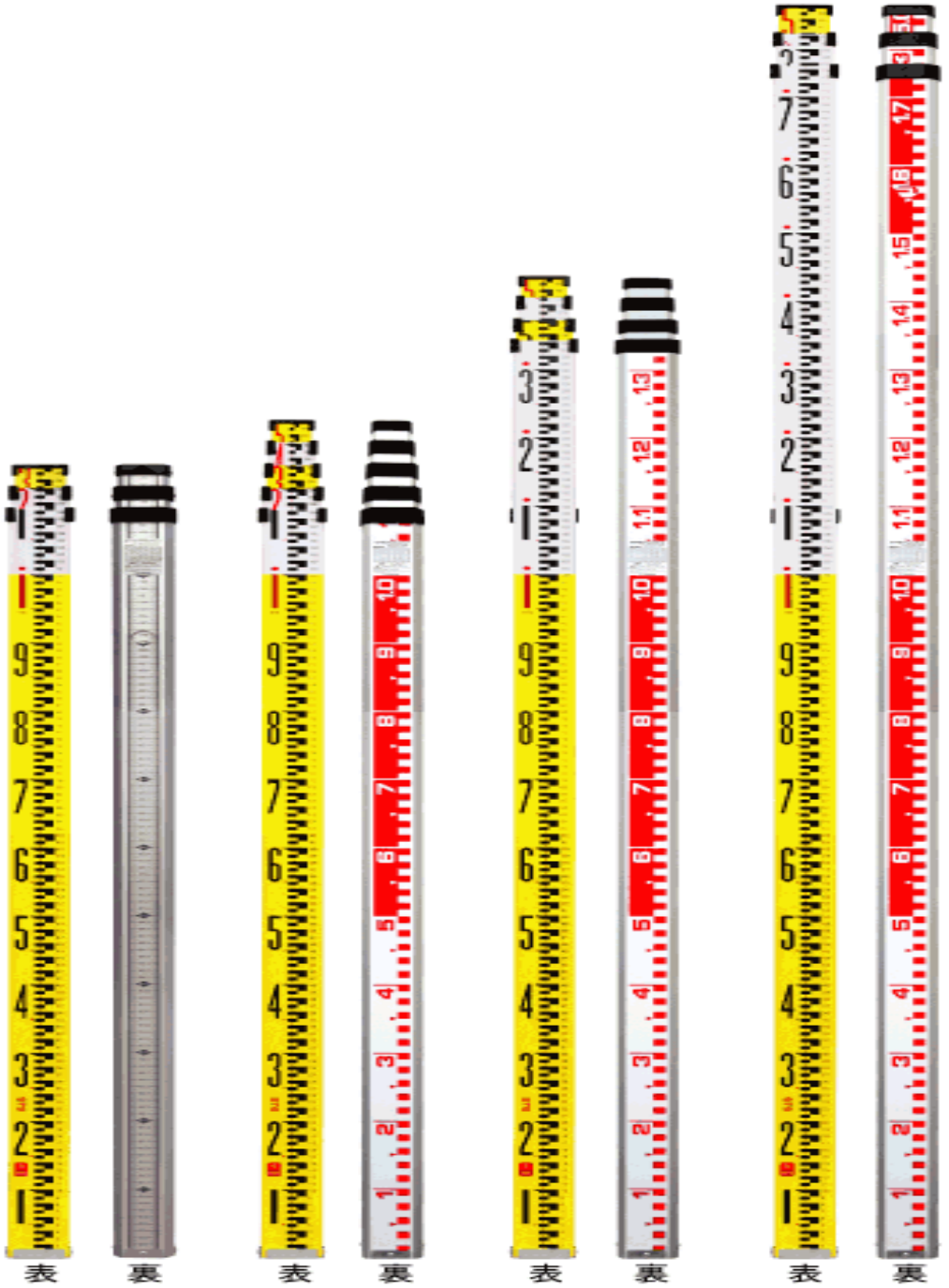
Instrumental Error



Main source of instrumental errors are:

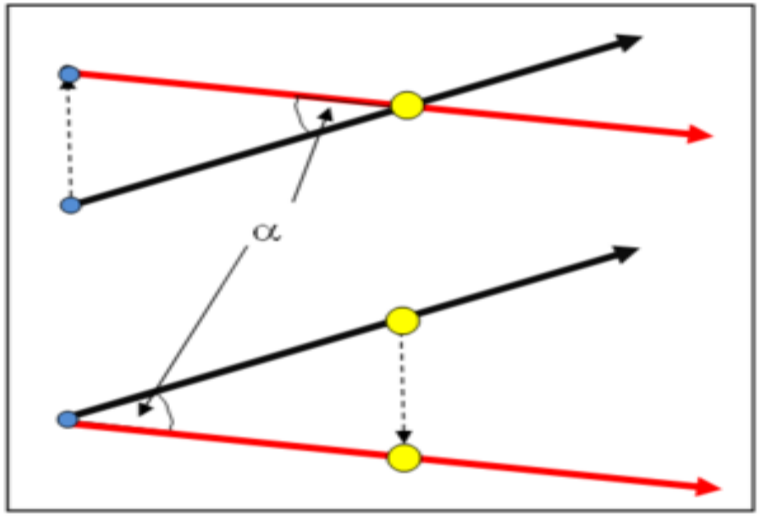
- **Parallax error**
- **Staff graduation errors** may result from **wear and tear** or **repairs** of the **staffs** .
- **Loose fixings of parts** will cause **twisting** and **movement** of the tripod head.


15
14
13


表
裏
TS-33
表
裏
TS-55
表
裏
TS-54
表
裏
TS-53

Accuracy and Error

Parallax - Parallax arises due to **change in viewpoint** occurring due to motion of the **observer** & of the **observed**, or **of both**.



Question: What is parallax? Describe with example.

Parallax error:

Parallax error occurs when the **measurement of an object's length is more or less than the true length** because of your eye being positioned at an angle to the measurement markings.

For example, a person **viewing a car's speedometer** from the **driver's seat will get an accurate reading** because she has a direct line of sight.

A person viewing the speedometer **from the passenger seat** will **over/under estimate the reading** because of the angle between his eye, the meter and the arrow.



Classification of Error

Errors met in all types of field surveying may be classified:

- **Mistakes**
- **Systematic errors**
- **Accidental errors**

Question: Briefly describe the different types of errors occur in surveying.

Mistakes:

- Arise from **inattention**, **inexperience**, **carelessness**, **poor judgment**, **confusion** in the mind of the observers etc.

- If **undetected,** it produces a serious effect upon the final results.

- Hence, every value recorded in the field, **must be checked by some independent observation.**

Accuracy and Errors- Mistakes

Examples of Mistakes:

- Erroneous recording such as 954 in place of 945.
- Counting 8 for 3
- Erroneous calculation of observed data.

Mistakes



Systematic error:

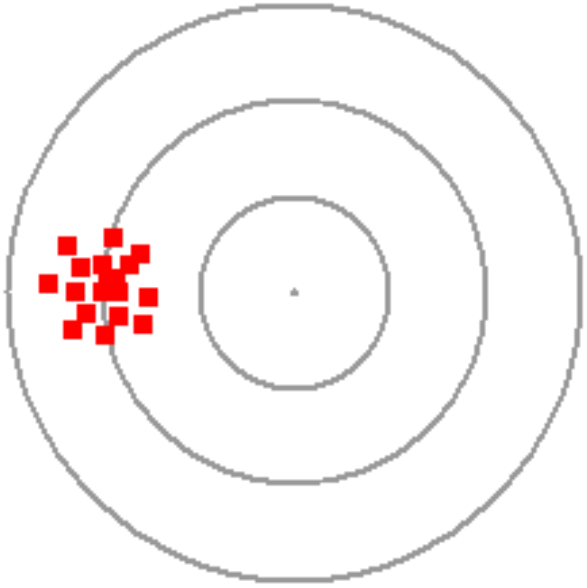
- An error that **under the same conditions**, will **always be of same size and signs.**

- Always **follow some definite mathematical or physical laws**, and a **correction can be determined and applied**.

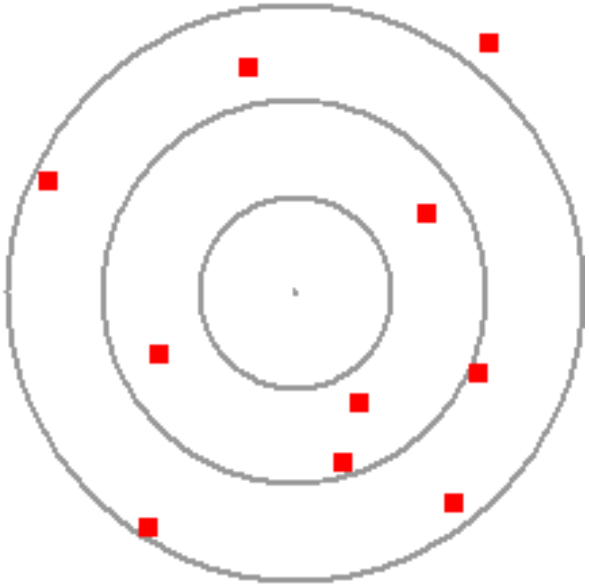
- Are of **constant in character** either positive or negative.

- **Effects** are always **cumulative**.

Systematic Error



Systematic Error



Random Error

Accuracy and Errors

Example of systematic error:

- A tape is **p cm short**.
- If **n times** measured by the tape.
- **Total error is pn (-), Correction will be (+).**
- If **not detected**, systematic error will be very serious.

Accuracy and Errors

How to avoid Systematic error:

- Equipment **sometimes are designed in such way** that systematic error is **automatically eliminated**.

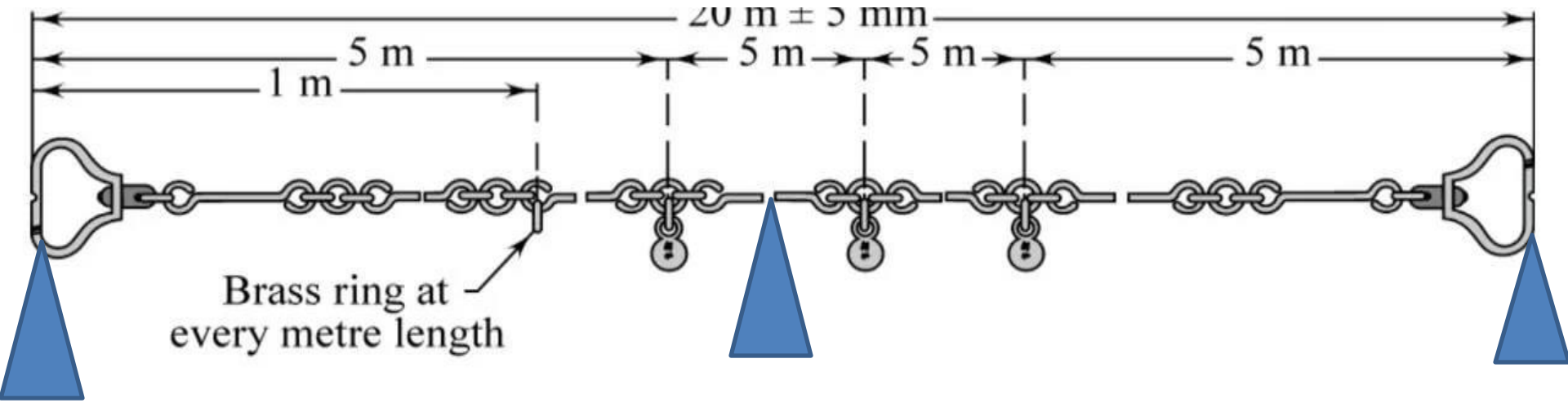
- Otherwise, it should be **evaluated at regular interval** and **relationship to be determined**, then **correction to the result is applied.**

- **Peg Test- to** eliminate the systematic error in chain.

Accuracy and Errors

How to avoid Systematic error:

- **Peg Test- to** eliminate the systematic error in chain.



Accidental errors:

• Accidental errors which **remain** **even after mistakes and systematic errors are eliminated.**

• Accidental errors are **caused** **by a combination of reasons beyond the ability of the observer to control.**

•Likely to **make the average results** too large or too small or compensate each other.

•**May be random or compensating errors.**

Accuracy and Errors

- Accidental errors are of **compensative** in nature and **tend to balance out in the final results.**

  Example: A 2cm error in a tape, may fluctuate on either side of the amount due to **small variation in pull**, which it is subjected.

Accuracy and Errors- Mistakes

Examples of Compensating Errors:

- **Discrepancy** between chain and tape measurement when both are used simultaneously
- **Inaccurate marking** chain length on the ground.
- **Inaccurate centering**.

Permissible Error

Permissible Errors

•**Maximum allowable limit of error** in **a measurement** may vary from the true value or values previously adopted as correct.

•**Value of permissible errors** in any given case **depends on**:

-Scale of map/plan.

-Purpose of the survey.

-Instruments used.

-Quality of works.

Accuracy and Error

	Traversing for	Permissible Angular Error	Permissible Linear Error
1.	Land Surveys and location of roads, railways, etc.	$1' \sqrt{N}$	1 in 3000
2.	Survey work for cities and important boundaries.	$30'' \sqrt{N}$	1 in 5000
3.	Important surveys	$15'' \sqrt{N}$ N = Number of Angles	1 in 10,000

Accuracy and Error

Limits of Errors in Chaining:

- For measuring over **rough or somewhat hilly ground**, the permissible error **is 1 in 250.**

- In **Ordinary Chain Survey**, the maximum permissible error is **1 in 1000.**

- If a **steel tape or a steel band chain** is used to obtain greater accuracy in measurements, the limiting error may be **1 in 2000**.

- When the **standardized steel or invar tape** is used the maximum error should not exceed **1 in 5000**.

Limitations of Surveyors for precise Works

Surveyor may be handicapped due to following reasons:

- Rough country side.
- Too short a time.
- Too small a party i.e. survey team.
- Poor instruments.
- Bad weather.
- Any other unfavorable conditions.

The **best surveyor is not he**, who is extremely accurate in all his works, **but he who does it** just accurately enough for the purpose **without waste of time and money**.

Question: Briefly describe the limitations of a surveyor doing precise works in the surveying.

Thank You